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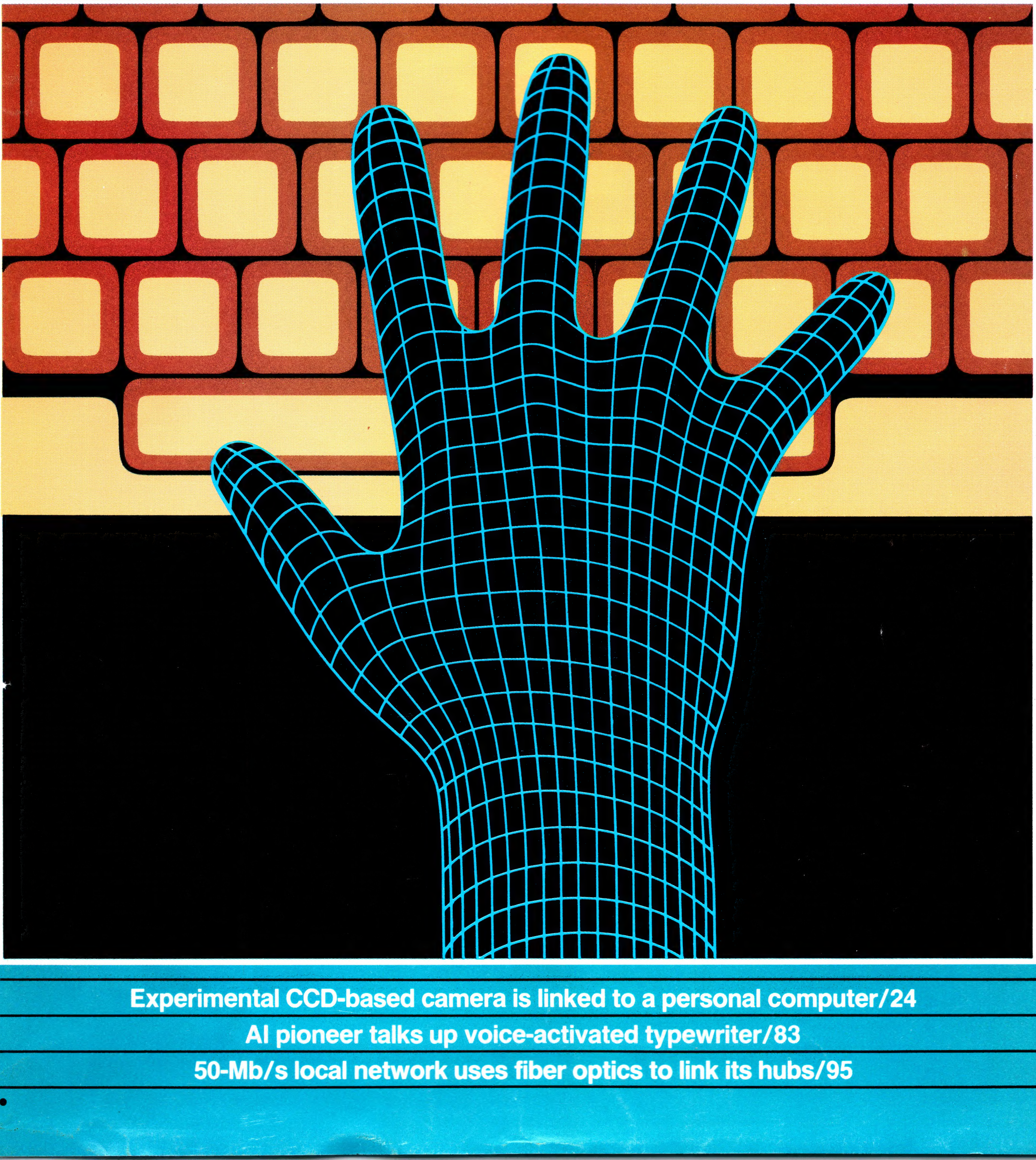
FINDING THE KEY TO REALISTIC 3-D/89



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Next ElectronicsWeek

Magnetic storage moves into new fields

From the beginning, the mainstay of computer memories has been magnetic storage. But the magnetic-memory community knows that as computer architectures demand more memory in smaller packages—for multiprocessor systems and network servers, computer-assisted design work stations, and private branch exchanges—only those ready with new technology will survive. So the industry is readying new recording materials and novel techniques to keep pace. A special report by Systems Integration Editor Robert Rosenberg in next week's *ElectronicsWeek* will explore the field, particularly thin-film recording media, thin-film heads, and perpendicular recording.

How VLSI testers answer the demands of complex technologies

As the price per function of semiconductors drops, production volumes increase. Not only that, but Japanese competition has made it all the more important to turn out quality products. Thus, it becomes apparent that cost-effective and first-rate test equipment is absolutely essential. Add to that equation a maddeningly diverse marketplace, with its varying complexities and various technologies, and the result is a big headache for manufacturers. But coming to the rescue are the very large-scale-integration testers as they open an important market. Get the details in the next *ElectronicsWeek.*

Looking ahead in ElectronicsWeek

Moving on to the whole spectrum of VLSI test equipment—and the technologies involved—will be a special report by Senior Editor Howard Bierman. It will dig into such areas as the latest in electron-beam and laser probing systems, integrating computer-aided design tools with very large-scale-integration testers, and other subjects of concern to the testing and semiconductor communities. Look for it in an upcoming issue of *ElectronicisWeek.*

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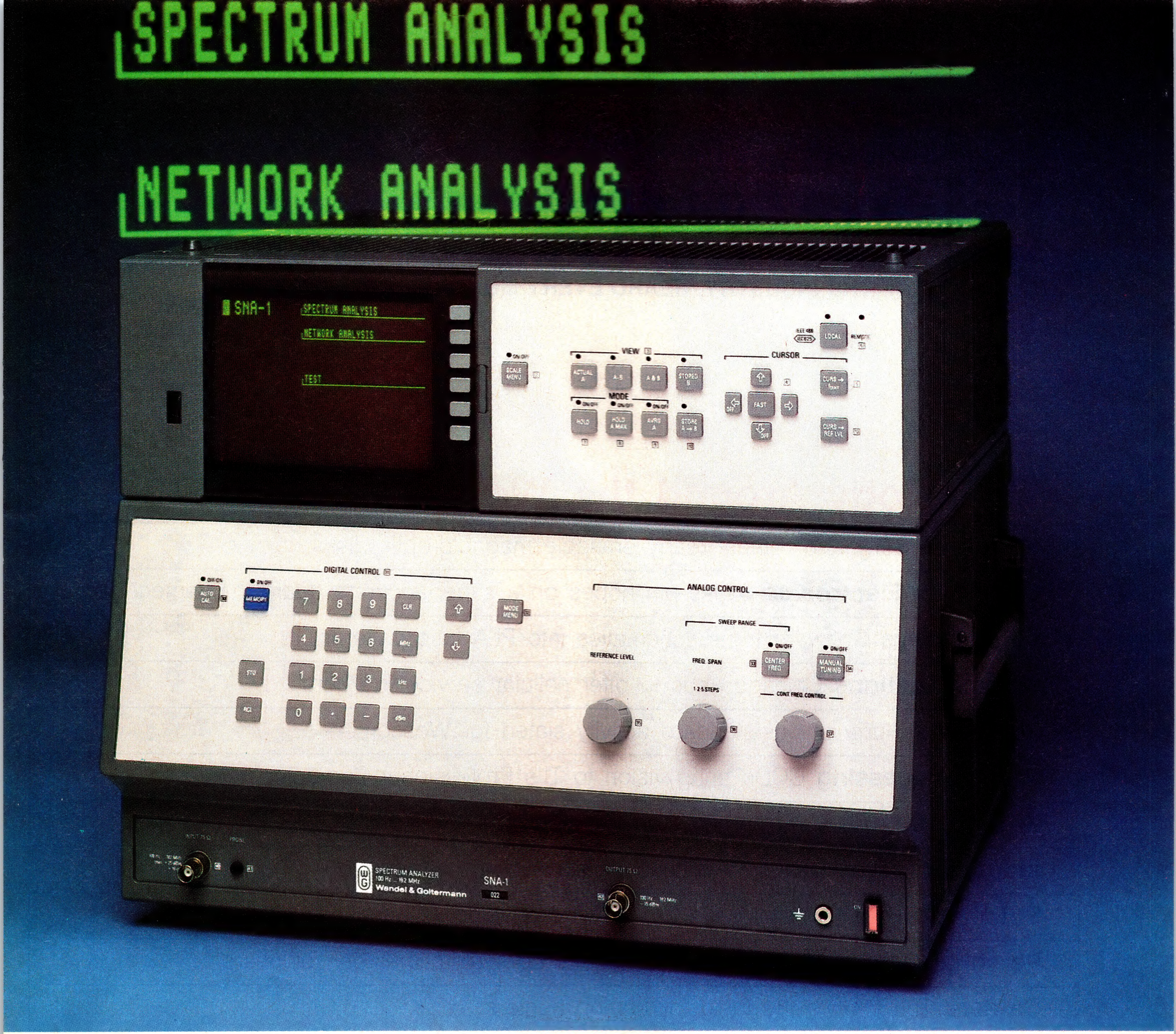

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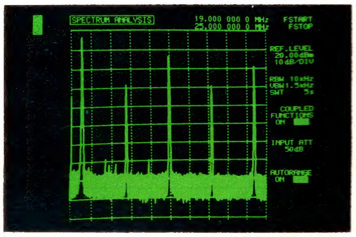

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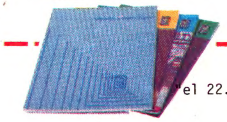

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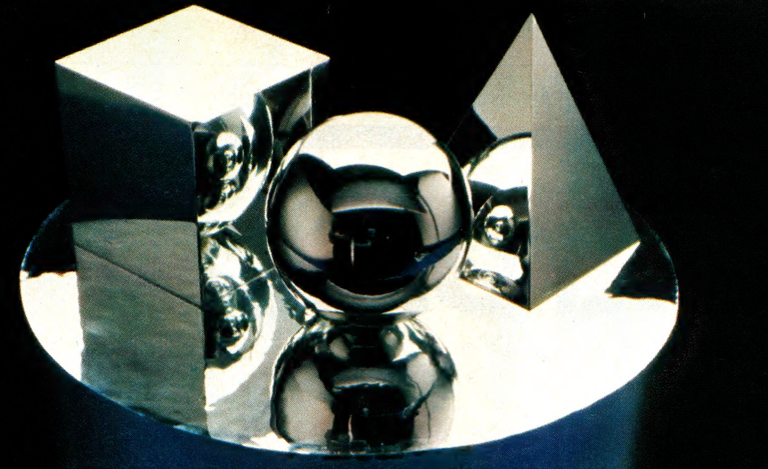

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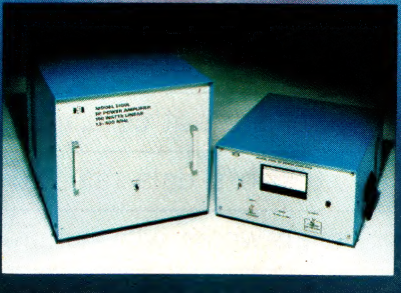

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ElectronicsWeek

Special Technology Reports

Computer Graphics Realistic renderings of three-dimensional objects on a computer terminal can increase the effectiveness of human interaction with computer displays. Key to producing realistic rendering is appropriate use of memory and dedicated processors **89**

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PRW

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Philips and Siemens to combine forces

Concerned at the dominance of U.S. and Japanese semiconductor houses in world markets, Philips, of the Netherlands, and Siemens AG, West Germany, have embarked on a memory-chip development program that could call for a combined outlay of $530 million during the next five years. On top of that, about $120 million is sure to come from the German and Dutch governments.

The aim of the program by Europe's two top chip producers, Siemens says, is to develop, by 1989, 1-Mb static random-access memories that Philips will produce and 4-Mb dynamic RAMs to be built by Siemens at a new plant in Regensburg. The German-Dutch cooperative deal also includes the development of a common CMOS technology for these memories as well as related computer-aided design techniques.

British government vetoes new data net

The British government has ruled out plans by British Telecom and IBM Ltd. to jointly operate a UK-wide value-added data network. The decision follows advice given by Oftel, the independent regulatory authority, which warned that the proposal would be anticompetitive [*ElectronicsWeek,* Aug. 13, 1984, p. 25]. Competitors feared that IBM's proprietary Systems Network Architecture would become a *de facto* industry standard, but British Telecom gave assurances that it would provide gateways to its own packet-switched network and work with IBM toward the long-term convergence of both standards (see editorial, p. 132).

Eight-millimeter video camera waiting to take wings

"Eight-millimeter camcorders will form the mainstream of the next generation of VCRs," says Norio Ohga, president of Sony Corp. Ohga is claiming excellent picture and sound quality for the units and and points out the greater practicality of the smaller cassettes. In addition, he says, the 8-mm format is standardized so there will be no repeat of the Beta-VHS schism.

Curiously, Ohga declines to say when his firm will start sales, even though Fuji Photo Film Co. will sell an 8-mm camcorder next March made for it by Sony. Initially, maximum recording time will be one hour, but Kodak has announced that about the middle of 1985 it will begin U.S. sales of two-hour tape manufactured by TDK Corp. on a private-label basis.

EC moves to open and harmonize telecommunications

European Community industry ministers, led by outgoing EC vice president Etienne Davignon, have agreed to open up at least 10% of national telecommunications equipment procurement to competition from other European suppliers. At a meeting in Luxembourg, the industry ministers also approved measures to promote the standardization of telecommunications throughout the 11-nation community. But good intentions won't have any impact unless national telecommunications agencies can be convinced to go along.

Davignon, who has made telecommunications policy a top priority for his remaining months at the EEC, said he approved of the British government's decision not to allow a IBM-British Telecom link up for a data network, believing that the joint venture "would complicate European normalization efforts." So, following the Luxembourg session, a special council was set up to develop market-opening plans.

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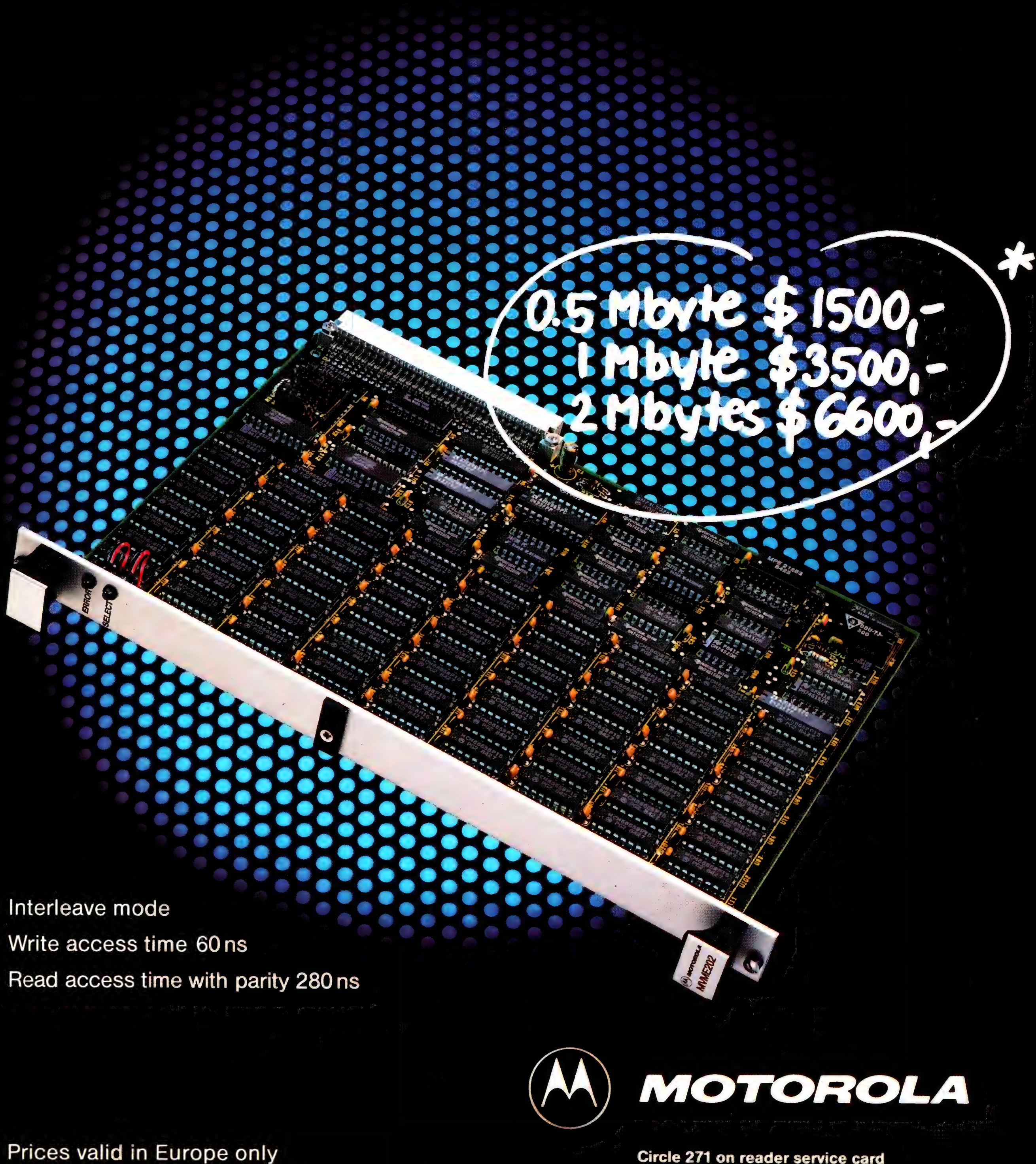

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VMEbus Products from Motorola

PRODUCT REFERENCE	DESCRIPTION
VME/10	
M68K102B2	VME/10 microcomputer system with 15 Mbyte Winchester disk, 655 Kbyte floppy disk, 5-slot VMEbus backplane and 4-slot I/O channel backplane
M68K102C2	As M68K102B2 with 40 MB Winchester
Processor Modules	
MVME101	MC68000 with 256 KB on-board memory space, system controller functions, 1-level bus arbiter, VMEbus interface, parallel I/O, 2 serial I/O ports, timer
MVME110-1	MC68000 with 256 KB on-board memory space, 1-level bus arbiter, VMEbus interface, I/O channel interface, 1 serial I/O port, timer
MVME115M	MC68010 with MC68451 192 Kbytes on board memory
MVME120	MC68010, MC68451, 64 Kbytes ROM area. 128 Kbytes dual ported RAM, 4 Kbytes Cache
MVME121	As MVME120 but with 512 Kbytes RAM
MVME128	MC68010/MC68451, 256 Kbytes dual ported RAM VMXbus interface
Memory Modules	
MVME201	256 Kbytes dynamic RAM with parity
MVME202	512 Kbytes dynamic RAM with parity
MVME222-1	1 Mbyte dynamic RAM with parity
MVME222-2	2 Mbytes dynamic RAM with parity
MVME211	1 Mbyte static CMOS RAM/ROM/ EPROM module
System Controllers	
MVME025	VME system controller
MVME050	VME system controller with memory and I/O

PRODUCT REFERENCE	DESCRIPTION
Peripheral I/O (VMEbus)	
MVME300	IEEE-488 GPIB controller with DMA
MVME310	Universal intelligent Peripheral Controller (UIPC) with free user area
MVME315	Intelligent floppy disk controller and SASI/SCSI interface with DMA
MVME316	VMEbus to I/O channel adapter
MVME319	Floppy disk controller and SASI tape controller interface
MVME320	Winchester/Floppy disk controller
MVME330-UX	Ethernet controller module with UNIX S/W
MVME330-VX	Ethernet controller module with VERSAdos S/W
MVME331	6-Channel intelligent serial communications module
MVME333	4-Channel intelligent high speed communications module
MVME340	64-bit parallel interface module
Peripheral I/O (I/O Channel)	
MVME400	Dual-Channel serial I/O
MVME410	Dual-Channel 16-bit parallel I/O
MVME420	SASI peripheral adapter
MVME435	Buffered 9-track magnetic tape adapter
Industrial (I/O Channel)	
MVME600	16-Channel analog input
MVME601	16-Channel expansion for MVME600
MVME605	4-Channel analog input
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trace

Digiscope 8612

```
>LIST
20 ?"FILTER INPUT",
30 GOSUB 1000
35 C1$=C$
40 ?"FILTER OUTPUT"
42 GOSUB 1000
45 C2$=C$
90 FOR I=1 TO 10
100 A$=RIGHT$(NAM$,6)
110 TRS$=A$
120 TST$="ERASE"
130 NEXT
150 TST$="NEW"
160 T1$=RIGHT$(NAM$,6)
170 ORI$=C1$
```

The intelligent BASIC programmable analog test and measurement system.

Signal Acquisition/Storage

The different plug-in-modules offer sample rates and resolutions of 1MHz – 12 bit, 10 MHz – 8 bit and 50 MHz – 8 bit. They can be „mixed or matched" since the mainframe is frequency independent. The high-accuracy 1 MHz – 12 bit plug-in has additionally differential inputs and, as the 10 MHz – 8 bit plug-in, two independent input channels with 4K memory/each. Every input channel is completely independent with its own time base, trigger control (delay and level) and memory. The DIGISCOPE 8612 is the first unit to offer analog combinational triggering from up to 8 sources. The standard BASIC programming capability allows even program-dependent triggering on tolerances, curves etc.

Color Display

Seven (7) different colors allow a clear discrimination of multiple traces. Up to ten (10) traces can be displayed simultaneously and each one can be individually controlled with its own two cursors. Zooming in both directions (X & Y) allows expansions to 40 points and compressions to 32,000 points.

Actual Measurement

Each displayed trace offers two direct measurements (DVM or Counter/Timer). Since there are 10 traces possible, up to 20 precise measurements can be made simultaneously. The two cursors in each trace allow also for sequential measurements.

The DIGISCOPE 8612 can be programmed in BASIC and run test sequences or present the measurement results automatically. The built-in Floppy Disk Drives and the IEEE – and RS232-C – interfaces provide the necessary links to computers.

FFT-Analysis as well as fast and higher level arithmetic calculations can be achieved with the optional software package, AMS II.

Documentation

Data Storage, i.e. storage of set-ups, test results, waveforms and special test and evaluation programs, can be „arranged" in the built-in Floppy Disk Drives or externally through the different interfaces. Even a hard copy in full color is available through the COLOR VIDEO GRAPHIC PRINTER, which is connected to the RGB – video output of the DIGISCOPE 8612.

Circle 129 on reader service card

trace

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Tel.: 0222/95 91 72

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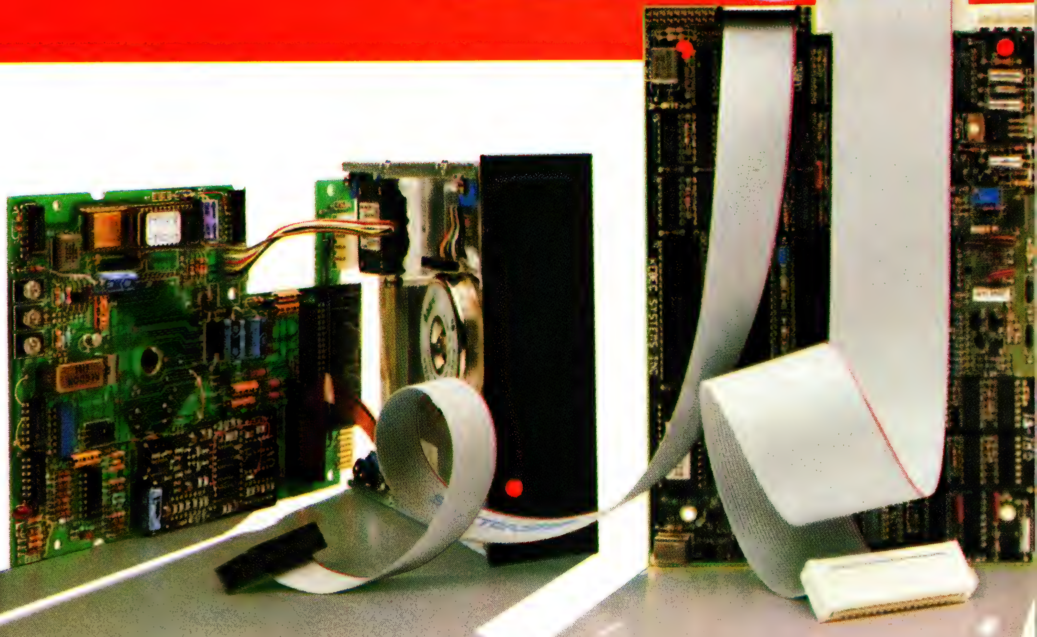
Xebec's New Owl Redu
Storage To

Then.



Microcomputer storage history has progressed by a series of small "next logical steps." A replacement of a component here, a refinement of technology there. But now Xebec has taken a giant step, with its Owl intelligent disk file.

On the surface, the Owl might look like other 10-megabyte, 5¼″ half-high Winchesters. Underneath, however, it's an example of superior technology. The integration of controller logic and drive electronics on a single board means not just one less PCB, but the elimination of expensive connectors and cabling, low power consumption (15 watts typical) and enhanced data integrity.

Single-board drive and controller electronics insure higher reliability

Integrated data separation within disk drive delivers higher data integrity

Ruggedized design includes head landing zone

Comprehensive diagnostics eliminate "What's wrong?" guesswork

Compatible with industry-standard Xebec SASI bus for faster system integration

We've put data separation in the HDA for precise control of data windowing and the elimination of background noise. We've provided a diagnostics channel to the host that delivers meaningful error messages.

Just as our superiority in minicomputer controllers led the way to a similar superiority in micro controllers, and our tested pairs solutions evolved from our considerable subsystem and testing experience, so too the Owl reflects our "top-down" engineering strategy—creating both technological and cost-of-owner-

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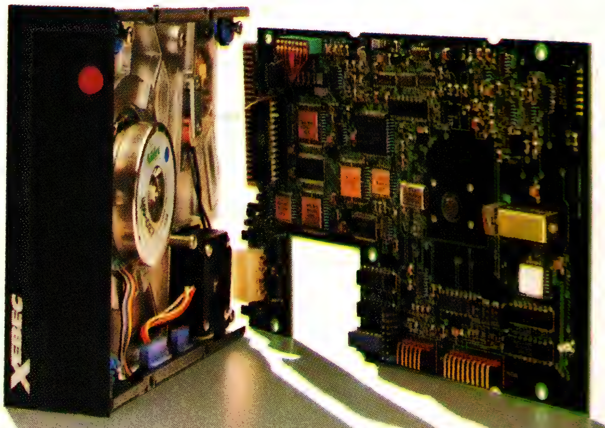

hip breakthroughs by designing sophisticated igh performance, multi-user features into small-ystem, single-user environments.

he System-Engineered Solution.™

s a major user of drives, and a major testing esource for other drive manufacturers, we are oncerned about drive reliability. And we've earned that it's not just a question of improving component or consolidating some board real state. The answer lies in careful consideration f overall system integration requirements.

he Owl epitomizes what we call the Xebec ystem-Engineered Solution. The focus is two-old: on today and on tomorrow. Compatible ow with industry-standard Xebec SASI, the wl—by eliminating the ST506 interface—is upwardly compatible for future higher densities, capacities and performance.

In broader perspective, Xebec's approach to OEM satisfaction rests on our proven experience, our vertical integration strengths—which now include production of heads and plated media—and our commitment to zero defect quality, by way of computer-aided design and robotics manufacturing.

Call Xebec today. Let us tell you more about the Owl. And how we can deliver the difference between then and now. Now.

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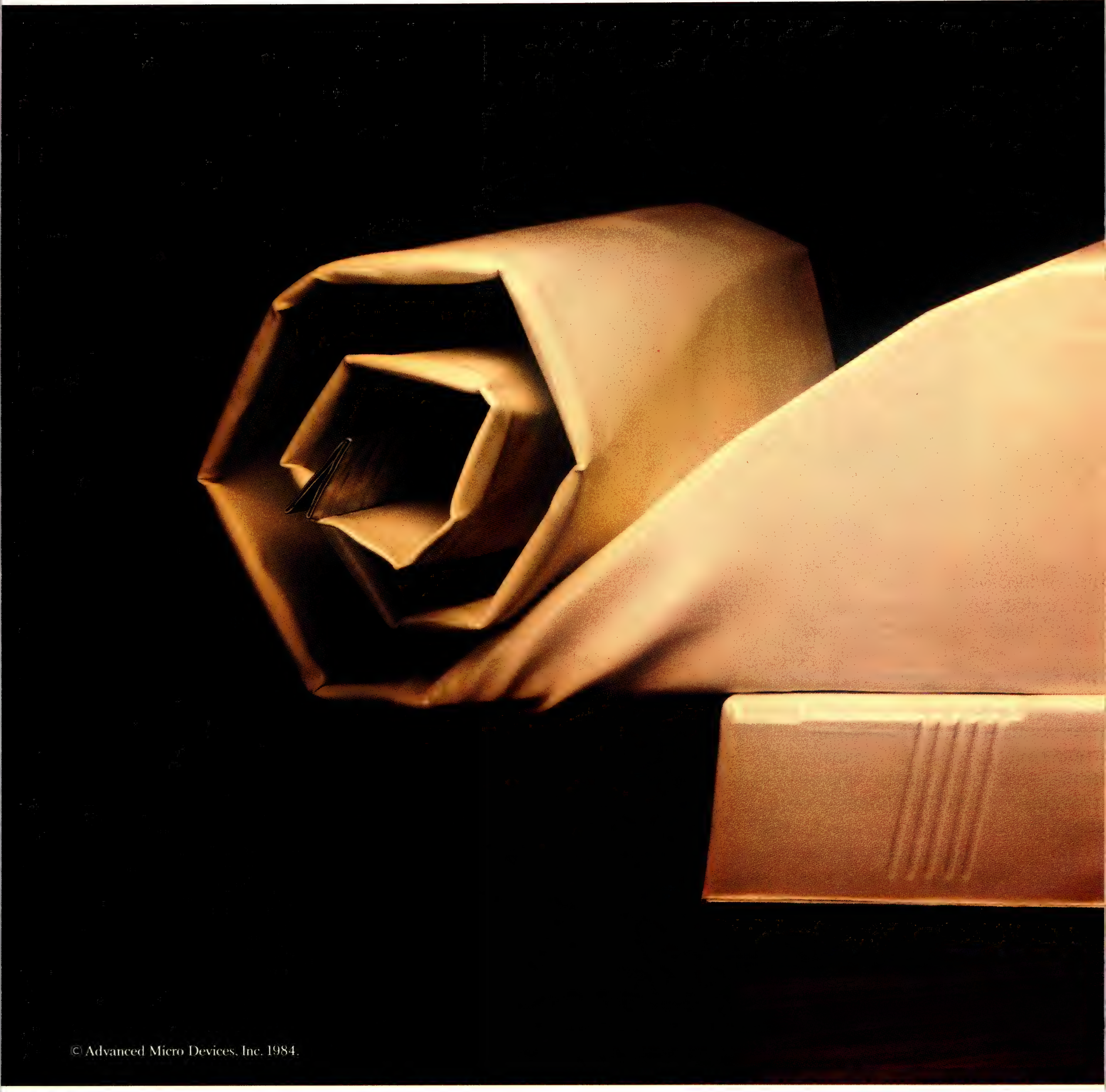

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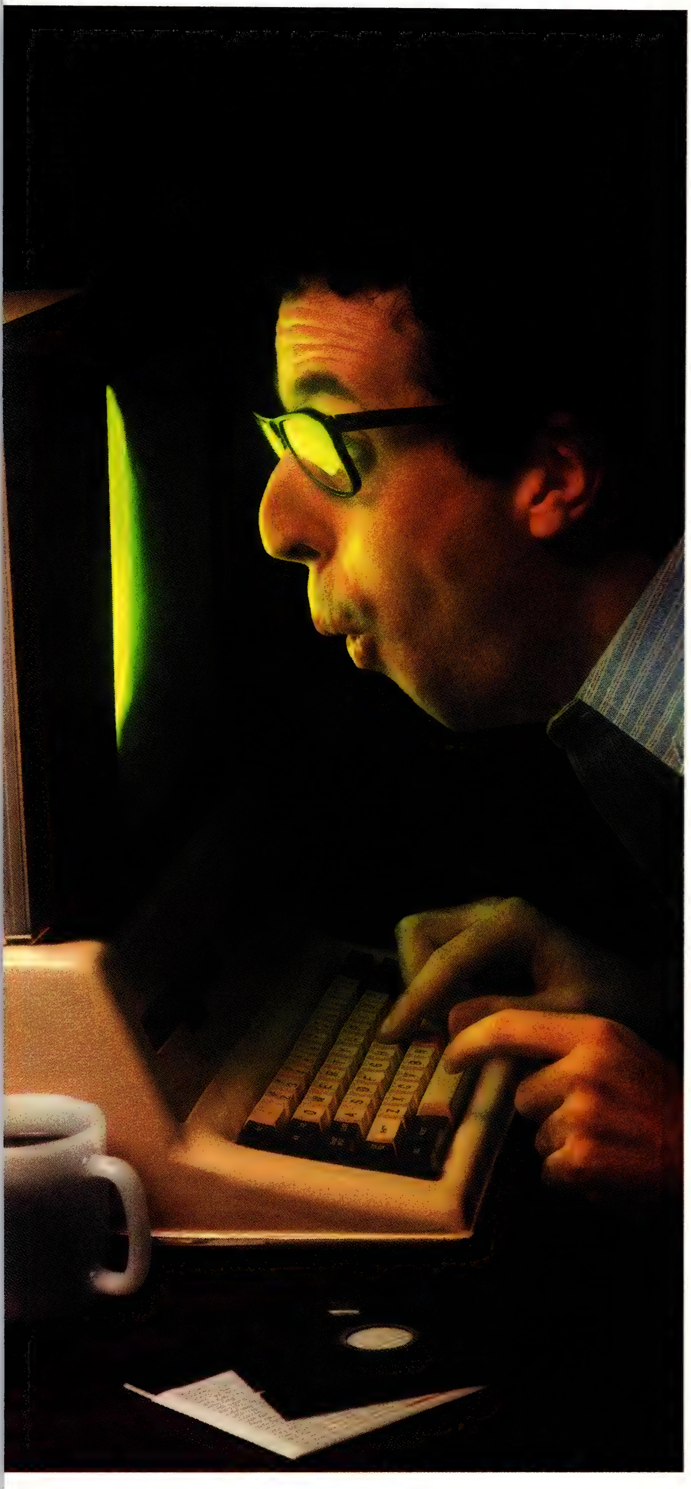
MORE OUT OF THE TUBE.



AMD's CRT controller family wrings every last drop of performance out of your video screen.

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NEC NEWSCOPE

NEC AND HONEYWELL BIND LONG-TERM COMPUTER TIES.

NEC and Honeywell Inc., have established a new 10-year business relationship in the computer field.

Under the new agreement Honeywell will market NEC's top-end mainframe, the NEC SYSTEM 1000, with GCOS-8 operating system, in the U.S. as the upper machine of its very large scale DPS-88.

The NEC SYSTEM 1000 is an ultra-large general purpose computer designed for large-scale processing in on-line data base systems, engineering calculations and communications networks.

It has a 64MB main memory and 128 KB cache memory. The NEC SYSTEM 1000 incorporates high-speed logic LSIs, high-density MO LSI memories and LSI high-densit packages with up to 60 chips mounted directly on a multilayere substrate.

A very large data array addres function gives direct access to a maximum of 1 gigabyte of data usi a virtual memory. The execution processing unit incorporates an integrated array processor which can efficiently work out large-scal vector and matrix calculations.

NUMBER 131

ALL-SOLID-STATE 10kW VHF TV TRANSMITTER.

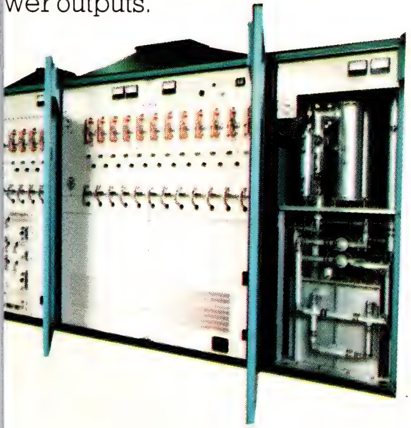
Today's most powerful all-solid-state VHF TV transmitter is available from NEC.

The 10kW transmitter incorporates verse new technologies. Advances clude high-efficiency high-power insistor amplifiers, low-loss RF mbiners, high-efficiency switching gulators and a high-performance iter. It has 12 transistor power nplifier units working in parallel in e video section and 4 such units in e audio section. These feature eatly reduced component counts. rubidium oscillator is used in con- ction with a synthesizer to assure tra stable carrier frequencies.

Compared to tube types, the new -solid-state transmitter offers many vantages including extra-high reli- ility, easy maintenance, unattend- operation and complete safety.

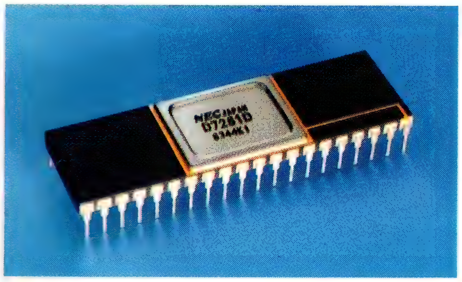
The first unit was delivered a year o and it continues to demonstrate isfactory performance.

NEC also offers all-solid-state TV nsmitters with 1kW, 3kW and 5kW wer outputs.



NON-VON NEUMANN IMAGE PIPELINED MICROPROCESSOR

Image processing demands repetitive high-speed operations on enormous amounts of data. To perform this task with maximum efficiency, NEC has developed the μPD7281D, the world's first non-Von Neumann type microprocessor with an amazing speed of 5 MIPS*. For processing an image of 640 × 400 pixels, it can rotate pictures or graphics freely to any angle at a speed of 1.4 seconds*.



By drastically reducing cost and size of image processing hardware, the new VLSI can add attractive features to CAD systems, facsimiles, copiers and other office automation equipment.

The μPD7281D is also well suited for high-speed signal processing and numerical calculations—for products such as digital filters, robots and NC systems.

The new VLSI features ☐Data-flow and flexible 5-block circular pipeline architecture. Different computations are independently 'data-driven' within the 5 blocks. ☐Separate input and output buses. ☐On-chip 16 × 16 bit multiplier. ☐200 ns* pipeline cycle for all operations. ☐32 PU instructions including barrel shift, bit operation and bit check. ☐Easy formation of multi-processor system for faster execution. ☐Support LSI soon to be available to interface the μPD7281D with host processor and memory. ☐Easy software development with flow graph, functional assembler and simulator.

*Target figures.

WORLD'S LARGEST LOCAL DIGITAL EXCHANGES IN SYRIA.

The world's largest-scale local digital exchanges are now in service in the Syrian Arab Republic.

The two NEAX61 multiprocessor digital switching systems in Damascus, the capital, and Aleppo accommodate 40,000 subscriber lines each. At the same time, another 20,000-subscriber line NEAX61 system was also put into service in Damascus, a model city selected by CCITT for telecommunications network digitalization.

Another feat achieved by NEC in the project was to carry out changeover from the existing systems (about 20,000 subscriber lines) overnight.

In addition to the switching systems, NEC has also delivered a total of 145 information service consoles and assistance service consoles.

NEC
NEC Corporation
Tokyo, Japan

The Definitive

Modulation Analyzer

Boonton's new 8200 Modulation Analyzer provides all the tools you need to quickly characterize baseband and modulated carrier signals—on the bench or over the bus.

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- Amplitude modulation, 0 to 99%, to 1% of reading
- Frequency modulation, 0 to 500 kHz deviation, to 1% of reading
- Phase modulation, 0 to 500 radians, to 3% of reading
- Audio frequency, 10 Hz to 200 kHz, to 0.1 Hz resolution
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Circle 16 on reader service card

SONY, HITACHI READY ERASABLE OPTICAL DISKS

Sony's 30-cm 1-gigabyte-per-side disk and Hitachi's 12-cm 0.55-gigabyte disk bring commercial magneto-optical gear into view

☐ *by Charles L. Cohen*

Tokyo

Like the cores of yore, yet another magnetic memory medium faces eclipse. This time, technological advance threatens the Winchester disk drive. It may fall into the shadow of magneto-optic erasable disks, which can pack a gigabyte of bits onto one side of a platter 30 cm in diameter.

The first prototypes are near at hand. Later this month, Sony Corp., best known for consumer electronics hardware, will deliver two drives for 30-cm disks and a controller for up to four drives to Kokusai Denshin Denwa Co. (KDD), Japan's overseas telecommunications monopoly. Sony claims these drives will be the first erasable magneto-optic disk systems in practical use for computer-data storage. (Last September, Sony announced that it was developing memory systems with KDD [*Electronics*, Oct. 6, 1983, p. 84].)

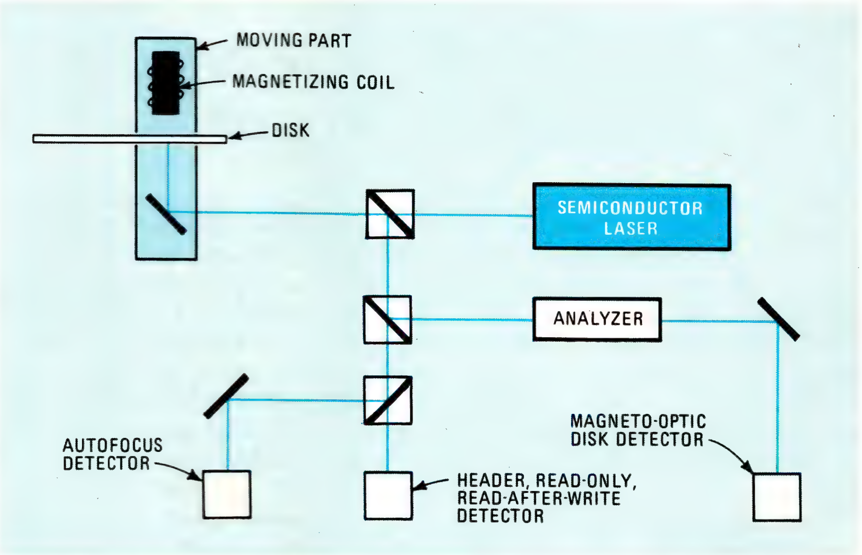
Close behind. Hard on the heels of Sony, Hitachi Ltd. has presented a series of papers on a 12-cm disk with a total capacity on both sides of 0.55 gigabytes. Neither firm has yet announced when it will sample or ship commercial products, but both imply that shipments are roughly two years in the future.

This presumably would make Sony and Hitachi the first two firms to get into the market with erasable magneto-optic data disks. (Sanyo Electric Co. was the first company to publicly demonstrate magneto-optic recorders for high-fidelity compact audio disks [*ElectronicsWeek*, Oct. 15, 1984, p. 12].) Write-only versions of optical data disks, however, should start appearing in quantity late this year or early 1985 from both U.S. and Japanese suppliers [*ElectronicsWeek*, Aug. 20, 1984, p. 19].

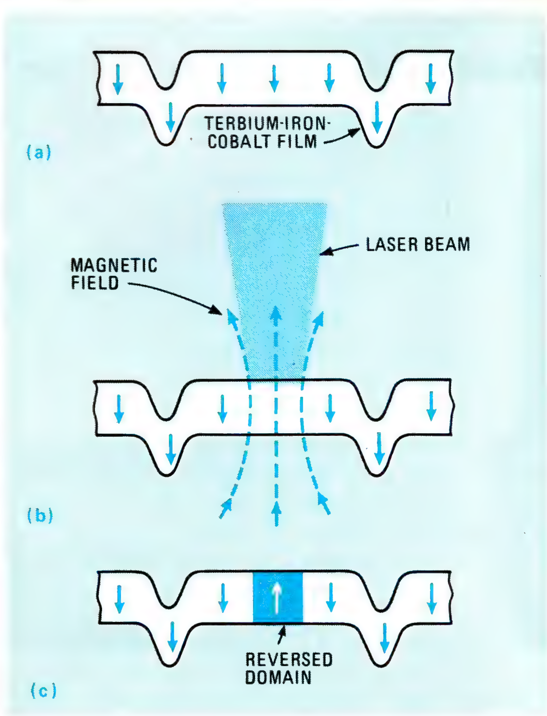
Hitachi, of course, is a long-time player in the data-processing business, but Sony is a newcomer in computer peripherals. So far, its only product line in the computer disk field line is 3½-in. floppy disks and drives, the first of which it announced in late 1980 [*Electronics*, Jan. 13, 1981, p. 44]. It is developing hard disks, though, including models for perpendicular recording. Hitachi manufactures a complete line of both floppy- and hard-disk drives.

Although they went for different disk sizes, both firms adopted a track pitch of 1.6 μm for their magneto-optic disks, which is rapidly becoming a standard for most laser disks. And there is another important similarity. Both claim an average access time of under 100 ms, achieved by splitting the rather complex write-read head into two parts to reduce the mass that must be moved.

In both designs, the part of the head that moves across the disk incorporates only a mirror for changing the direction of the beam, an objective lens for focusing the beam on the disk, and a small coil for supplying the weak magnetic field required for recording. The laser, the polarization analyzer for readout, the photodetectors, and other optical compo-



Moving parts apart. Elements that must dart back and forth over the disk—the tracking mirror, objective lens (not shown), and magnetizing coil—ride in a carrier separate from the other system components—such as the laser, analyzer, and detectors.



Ups and downs. Magnetic film on grooved disk has domains originally oriented in one vertical direction (a). When a weak field is applied, demagnetization occurs where the laser spot heats the film to its Curie temperature (b). The field then reverses the domain (c).

nents are in the stationary portion (see figure, p. 17).

Sony fabricates its disks from the same acrylic material that it uses in audio compact discs. The 30-cm disks rotate at 900 rpm and have 43,750 tracks with 25 1-K-byte sectors per track. Sectors are hard-formatted with embossed pits in the track.

Data rate. Data transfer rate is nominally 650-K bytes/s, but the total number of bytes stored is more than double that of users' actual data to give redundant bytes for error correction. Thus users' data rate is more like 320-K bytes/s.

The Sony disk requires less than 6 mW for writing and less than 1 mW for readout. Actual laser power is about 30 mW for writing and 3 mW for reading.

Hitachi engineers say that they managed to improve the signal-to-noise ratio of their disks by writing on the lands between guide grooves rather than in them (see figure, above). They developed a terbium-iron-cobalt alloy with a Curie temperature of 240°C because it allows readout using a relatively large laser for high output and high signal-to-noise ratio.

Sony uses an alloy with a Curie temperature of only 170°C to 180°C. To ensure good dimensional stability and optical properties, Hitachi engineers chose an epoxy resin.

Energy required for writing on the disk is 7 to 8 mW from a 20-mW laser, while that for readout is 1 to 2 mW. These values are the same ones Hitachi used for direct-read-after-write and for read-only disks, both of which are compatible with the experimental drive used for magneto-optic disks. Yoshito Tsunoda, senior researcher at Hitachi's Central Research Lab, says that the carrier-to-noise ratio of the disks is typically 57 dB. The uncorrected error rate is 10^{-6}; after error correction it is 10^{-12}.

The Hitachi magneto-optic disks spin at 1,200 rpm and have 17,000 tracks per side, with 32 hard sectors per track. Embossed pits are used to format sectors. Sectors have a total of 690 bytes, of which 512 bytes are users' data. The data transfer rate is 440-K bytes/s.

CONSUMER

Swiss pin hopes on quartz watch

St. Imier, Switzerland—The Swiss horological industry will be closely watching an all-out effort by Compagnie des Montres Longines Francillon S.A., located here, to define and create a top-of-the-line market for quartz wristwatches based on advanced technology rather than on style and precious metals.

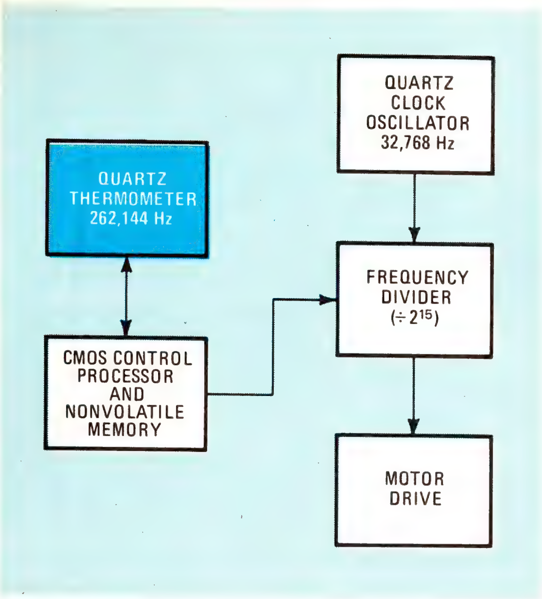
Ever since quartz movements made mechanical clocks all but obsolete, Japanese competition has been ravaging the once mighty Swiss watch industry. The reason is simple: quartz precision is identical in Tokyo or Geneva, and the adaptability of quartz movements to mass production has also helped to nullify Switzerland's advantage of several centuries' experience in traditional mechanical craftsmanship.

Longines's answer to that seeming dilemma is its line designated Conquest VHP, for Very High Precision, a collection of watches that the company has just begun marketing with an aggressive worldwide advertising campaign under the banner "Swiss achievement." The movement not only is five times more accurate than a standard quartz clock mechanism, claims Longines, but offers a number of other significant advantages to the user, such as improved battery life and complete freedom from adjustment for the life of the watch.

Keeps its cool. Basically, the VHP movement replaces the trimmer used to calibrate the oscillator in a standard quartz movement with a digital integrated circuit that stores the calibration parameters in a nonvolatile memory. In addition, a quartz thermostat compensates the movement for any changes in temperature. The net result is that the two principal reasons for inaccuracy in quartz timepieces—frequency drift from the adjustment trimmer and sensitivity to temperature changes—are all but eliminated.

Like a standard quartz movement, the Longines system begins with a 32.768-kHz clock oscillator whose frequency is divided in half 15 times to create a 1-Hz, or one pulse/s, output signal to drive the clock's motor. When the movement is adjusted after fabrication, digital calibration data is recorded in a nonvolatile memory integrated on a 5,000-transistor CMOS chip, which also includes the system's control processor. The processor uses this input to apply a variable capacitance to the frequency divider should modification of the signal be necessary to achieve a precise 1 Hz.

A second quartz oscillator controlled by the processor circuit operates at 262.144 kHz and responds to changes in temperature with linear sensitivity. A 10°C increase in temperature, for example, corresponds to a doubling of the oscillator's frequency. A 20°C rise quadruples the output frequency. The control circuit decodes this input and again applies


QUARTZ THERMOMETER 262,144 Hz
QUARTZ CLOCK OSCILLATOR 32,768 Hz
FREQUENCY DIVIDER (÷2¹⁵)
CMOS CONTROL PROCESSOR AND NONVOLATILE MEMORY
MOTOR DRIVE

Slimmer by a trimmer. The Longines VHP movement replaces the trimmer in a traditional quartz circuit with digital circuitry. A quartz thermostat compensates for sensitivity to temperature changes.

a corresponding variable capacitance to the frequency divider so that its output pulses are either speeded up or slowed down as a function of temperature.

The result is a watch that runs with an accuracy of ±1 min over a period of five years. What's more, the Conquest VHP was designed to use a lithium battery, which means that it can run for at least five years without a replacement.

Adding to the battery's life, the sole high-power-consumption component, the oscillator thermostat, functions only once every 4 minutes for a period of 4 seconds. The nonvolatile memory, once programmed, consumes no power.

Although development of the Conquest VHP was coordinated by Longines, the company had plenty of help from its Swiss friends and neighbors. The quartz thermostat was developed with the help of Asulab S.A. and the control circuitry was designed and produced by the Centre Electronique Horloger S.A., both in nearby Neuchâtel.

Should the movement be a commercial success, the first sign will be its adoption by other brands such as Omega and Tissot, which, like Longines, belong to the Eta S.A. Group. Eta, located in Granges, supplies most of the components to most of the Swiss watchmakers since the country's industry streamlined its operations in the face of Japanese competition that has devastated the industry. –**Robert T. Gallagher**

LOGIC ARRAYS

Software turns schematics into PLA fuse patterns

Palo Alto—More and more, designers are eschewing boardfuls of TTL packages and turning to user-programmable arrays to integrate the glue logic needed to cement large-scale chips into systems. The action in arrays, in fact, has become so heavy that this year's market is projected at $130 million, and the rush is on to develop support tools to simplify programming.

The most ambitious system so far—a software package that turns a schematic diagram into a pattern for selectively blowing fuses to establish gate connections—will have its debut next week at Wescon, in Anaheim, Calif. That package is tied to a specific product—programmable logic arrays from Altera Corp., Santa Clara, Calif. However, generic development systems that can operate with any manufacturer's integrated circuits will be along very soon after, making field-programmable logic an even more attractive option in application-specific chips.

Do-it-yourself. Programmable logic makes it possible for system designers to buy a standard chip and program it themselves for a specific function, exactly as they would implant software in programmable read-only memory. A circuit can be designed and built in days at a cost of only a few thousand dollars, versus weeks and tens of thousands of dollars for gate arrays.

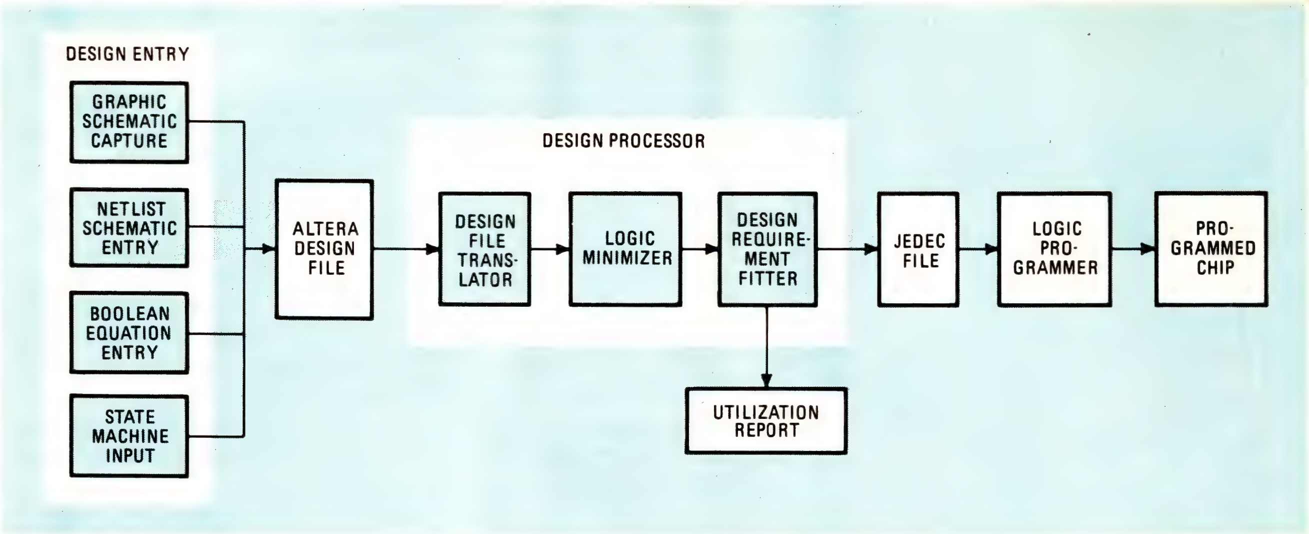
Actually, it has been possible to program logic for as long as it has been possible to program memories, but the former process has been slow to develop past the stage of writing low-level Boolean equations. Now that very large-scale ICs carrying thousands of functions are beginning to appear, more powerful development tools are needed.

PC to blown fuses. Using the system Altera will show at Wescon, a designer can lay out a circuit on an IBM Corp. Personal Computer or PC/AT and then use the resulting schematic diagram as input to an applications program that turns it into a Joint Electron Device Engineering Council file (see drawing, p. 20). That file, in turn, drives the programmer that blows the fuses—in Altera's case, floating gates that can be turned on and off by exposure to ultraviolet light.

The single design process of laying out the circuit is enough to produce a finished chip within minutes. It also produces a utilization file, telling the user how the chip implemented his logic.

Altera won't be alone at Wescon with tools that use gate arrays to transmute circuit designs into silicon. For example, Data I/O Corp., of Redmond, Wash., will show its capability for schematic capture. Data I/O markets ABEL (for Advanced Boolean Expression Language), a tool for producing fuse patterns from logic states, truth tables, and Boolean expressions. Its new product will mesh with the DASH-2 design software produced for the IBM PC by Futurenet Inc., Canoga Park, Calif. The Data I/O package will accept truth tables and logic states as inputs, as well as the basic Boolean equations. Assisted Technology Inc., San Jose, Calif., also promises schematic-capture capability for its CUPL fuse-programming language.

"Schematic diagrams are without question the universal design language of electronics," says Clive McCarthy, director of applications at



Blowing fuses. Design inputs to generate fuse patterns for Altera's programmable logic device include circuit schematics, net lists, Boolean equations, and state-machine languages. The design processor converts the input information into a Jedec file that drives a logic programmer.

Altera. "Designers can now use that language for programmable logic, just as they do for gate arrays." McCarthy views schematics as a high-level language and compares working with Boolean equations to programming in assembly language.

Differing opinions. "That's a hot and controversial subject," says John M. Birkner of Monolithic Memories Inc., Santa Clara. Birkner, the inventor of the firm's programmable array logic circuit, adds that "There have been many proposals for hardware design languages. The early ones took the simplest approach to explicit logic definition, Boolean equations. There are still a lot of opinions about what is the next level up."

Birkner points out, however, that high-level Boolean languages have been developed that considerably simplify the task of designing in logic. There are also high-level macrocircuit blocks that allow designers to specify entire subsystems with a single instruction. And state-machine languages are useful in designing industrial controls.

The Altera system accepts state-machine descriptions, net lists, and Boolean descriptions as well as schematic diagrams as input. "They have a nice approach in that they are trying to cover all bases," Birkner says.

The first two circuits to come from Altera, 300- and 1,200-gate equivalents, are currently being made in Japan, but the firm will soon begin shipping circuits made by the giant Intel Corp. of Santa Clara. Altera swapped rights to its software for rights to Intel's high-performance CMOS erasable-PROM process. Altera's current product, with a 45-ns propagation delay, is slow next to the 15-ns bipolar parts from Texas Instruments Inc. and Monolithic Memories. Intel, which does not now make programmable logic, also has the rights to second-source the Altera circuits if they catch on.

Altera's McCarthy expects the availability of a schematic capture process to make programmable logic more popular. "A lot of people have avoided it because they don't like to design in Boolean algebra," he says. "Working from schematics and net lists is standard for gate arrays and custom semiconductors." Assisted Technology president William Sams agrees. "Not a lot of engineers are comfortable with equations," he says.

Monolithic Memories owns the biggest share of the this year's projected $130 million market for PLAs. Advanced Micro Devices, Signetics, and National Semiconductor also have significant efforts. TI's recent aggressive entry into the market [*ElectronicsWeek,* July 23, 1984, p. 21] makes it a formidable force, says Sams. **–W. Clifford Barney**

CELLULAR RADIO

Cabbies expected to hail cellular service in market test

Chicago—Ameritech Mobile Communications Inc. has already installed cellular-radio telephones in rental cars, trains, and sailboats. Now, the subsidiary of Ameritech Inc., also located here, is letting others reach out and touch someone from the back seat of a taxicab.

In a 60-day trial program beginning this month, 35 cabs will hit the streets of Chicago as part of the first fleet in the nation to be equipped with cellular telephones. With phones and installation provided by AMCI, the trial is part of a marketing job that has proven somewhat tougher than anticipated for the firm that brought up the country's first cellular system here one year ago. AMCI fell about 11% short of its goal of 12,000 mobile cellular units in the field by the system's first birthday on Oct. 13.

Street smart. The taxi test is in line with what AMCI calls a seeding program, begun at Fortune 500-class companies earlier this year to get cellular business rolling. When sales at major accounts developed too slowly, the firm last spring began installing

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For technical data circle number 21

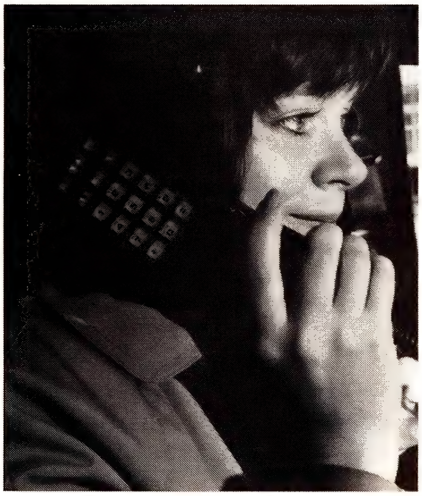
phones in executives' cars on a trial basis, with an option to remove the unit at the trial's end.

"We haven't had a phone taken out yet," says Katie Boudas, an AMCI representative. She adds that the program is beginning to pay off as corporate officials order more phones for their sales staff, field installation people, and other employees who drive regularly.

Cab costs. AMCI will provide cellular phones supplied by General Electric Co.'s Mobile Systems Division, Lynchburg, Va., and Oki Electric Industry Co., Tokyo. Cab owner-operators will be billed the usual $22 per month access charge and will pay the standard rate of 38¢ per minute of use from 7 a.m. to 7 p.m. and 22¢ at other times.

The cabbies will resell the service to their riders at 85¢ per minute on local calls, based on the phone's elapsed-time display. Long-distance calls must be made collect or by credit card. At the end of the trial period, the cabbies will be able to buy the phone for $2,500, lease it for $50 per month, or have it removed.

AMCI expects the heaviest use from business travelers, who could reach for a phone while stuck in traffic. "If phones in taxis become common and a cab driver doesn't have one, he'll be at a competitive disadvantage," observes Boudas. Even if it is used an average of only five minutes a day, she adds, the cabbie would reach the break-even point on a leased phone. **–Wesley R. Iversen**



Telephone interface. Marketing trials in executives' autos point to wide acceptance for cellular phones. People riding in taxicabs are the next market target.

STANDARDS

Bus-norm effort slated for Wescon

London—There will be plenty of leading-edge hardware out in the open to gawk at during the upcoming Wescon Exhibition and Conference, but there'll be significant action off the floor as well.

At the Anaheim, Calif., show next week, the behind-the-scenes specialists who spend long hours turning manufacturers' proprietary specifications into industry-wide standards will be hard at work. After that, at a meeting hosted by National Semiconductor Corp. in Santa Clara, Calif., a group officially known as the P896 Futurebus Committee of the Institute of Electrical and Electronics Engineers expects to wrap up its efforts on a 32-bit asynchronous bus.

Bus rides. First on the Wescon agenda will be the new generation of high-performance bus standards for new-generation 16- and 32-bit microprocessors. The second meeting of the IEEE committee set up to approve Texas Instruments' Nubus 16/32 bit specification will start the ball rolling at the Sheraton Anaheim Hotel on October 31.

NuBus has about the same performance as its main rival in synchronous bus structures, the Multibus II standard, championed by Intel Corp., Santa Clara. Yet another contender for 32-bit systems is the asynchronous VMEbus backed by Motorola Inc.'s Semiconductor Products Sector, the U.S. Philips Corp. subsidiary Signetics Corp., and Mostek Inc., a subsidiary of United Technologies Corp.

On November 1, the IEEE Systems Architecture Study Group will follow at the same venue, where one of the hot topics will be address-map assignment. This technique comes into play when boards of different standards, such as VMEbus and Multibus II, communicate.

The idea is to transfer data and messages between boards without having to change a single line of code. Registers are designated to the task on each board. So by assigning fixed addresses to all registers, in a geographic addressing scheme, data and messages can be transferred between boards without changing any of the code.

Moving the tent. The standardization circus next moves to Anaheim Hilton and Towers, on November 2, for the second meeting of the Multibus II committee.

Intel is now pushing hard to obtain IEEE approval for its bus, largely because potential users are wary about a standard in the hands of a single company. A first meeting was held in Dallas on September 12 and will, from now on, be pushed ahead under Paul Borril, whose chairmanship of the Futurebus committee will shortly draw to a successful close.

Borril, a researcher at the Mullard Space Science Laboratory, near Dorking, England, has no vested interests in the success of any bus standard, although, as a former adviser to Intel on its Multibus II, he is well suited for the chairman's role. He will be looking to maximize the commonalities between Multibus II and other IEEE board standards.

Heading north. Finally, the venue changes to Santa Clara, where National Semiconductor will play host on November 5 to the P896 Futurebus committee during its final meeting. This standard, believes committee chairman Borril, now looks set to win a niche for itself in the high-performance sector of the market. Recent simulations point to a bus performance of 30 MHz, roughly three times that of Multibus II. The committee's last act will be to wrap up a scheme for aligning cache stores.

In a multiprocessor setup such as Futurebus, the cache store serves to fetch off-board data, called for by its local processor. The data is then ready at the second access. This unburdens the bus of data traffic but raises the problem of keeping all data copies held in cache stores aligned.

A scheme has been developed and proved out by John Theus, Tektronix Inc., Beaverton, Ore. This scheme, which should be ratified by the committee, uses Futurebus's broadcast-on-address facility to align stores. National Semiconductor, meanwhile, will be describing support circuits for Futurebus. National has already de-

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Circle 22 on reader service card

veloped the necessary high-performance glitch-free bus drivers, the essential circuits in the bus performance, but still needed are suitable bus-arbiter chips. –**Kevin Smith**

IMAGE PROCESSING

TI keeps an eye out for its PC

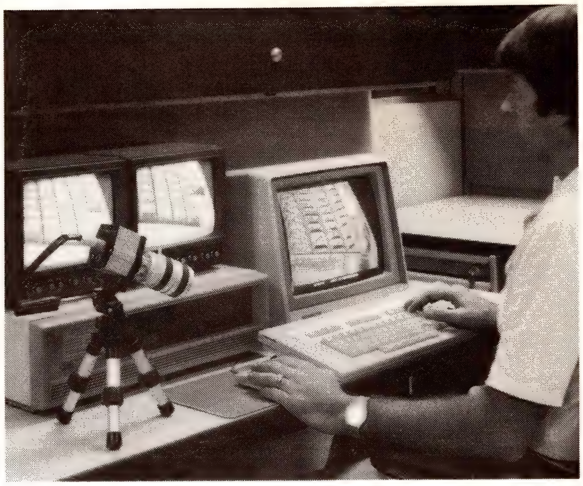
Dallas—For over a year, microcomputers from Texas Instruments Inc. have had an ear for human speech commands. Now, just peeking out of TI's Central Research Laboratories are experimental peripherals, built around charge-coupled devices, that bring vision to these machines.

The lab's monochrome image-acquisition system can grab a full frame of television-resolution data in 20 ms. Once digitized and stored in memory, the 16-bit TI Professional Computer can process the image just as it would any other data.

Project leaders in the Dallas lab suggest a wide range of applications for the potentially low-cost digital imaging systems. These range from burglar alarms fitted with artificial intelligence systems that detect only certain kinds of motion, to industrial robotics, to medical and science applications that better human views of materials through pseudo-coloring.

Sizing up CCD. Intended as an exploratory vehicle to demonstrate new uses for advanced CCD technology, the imaging system consists of a TI-made monochrome microcamera, interface hardware on a standard TI PC peripheral expansion card, as well as color-mapping software. Once the camera's 390-by-584-pixel CCD has an image, the computer interface board quickly digitizes the incoming pixels into 8-bit bytes and stores the data into two banks of interleaved 64-K-byte random-access memory.

The data in the frame buffer can either be stored on a disk, displayed on the system's cathode-ray tube, or processed with software that interactively maps eight colors to the monochrome image's 256 levels of gray, says Robert J. Gove, the technical staff member working on the project.



Processed. A CCD-camera image of 390 by 584 pixels is digitized and stored in memory. It can be displayed in black and white or processed for eight colors.

The program for color conversion, written in Pascal, paints the image by way of selectable eight-color thresholds in about 3 seconds. Gove is working on an assembly-language program that would speed up the process to less than a second.

Paramount in the CCD personal computer system project are speed and size. The peripheral interface hardware slips into one peripheral expansion slot inside the TI PC, and software is executed by the system's 8088 Intel microprocessor and optional 8087 math coprocessor. Still, it must not impede the high-performance of TI's microcamera, based on a logic gate array, full-custom video processor, and the firm's virtual-phase CCD technology. Unlike multiple-phase CCDs, virtual-phase devices have no overlapping electrodes. This lowers costs because of high yields in production and tightly-packed sensing elements [*Electronics,* Jan. 27, 1982, p. 39].

Mating game. "Since it [the camera] was in existence and PCs were around, it seemed obvious that we should put these together," says Gove, recalling when the project began at the first of the year. The goal was to build an imaging system that surpasses the performance of expensive equipment used on larger mainframes. No cost estimate has been made for the system, but it is expected to be significantly less than the larger systems.

(Cont. p. 29)

Research lab sells CCD cameras on the side

Occasionally, research laboratories make uncharacteristic moves to bring the potential of new chip technology into clearer focus. Such is the case with the group pioneering charge-coupled devices in the Central Research Laboratories of Texas Instruments Inc., Dallas. It is making and selling hundreds of CCD-based cameras as a sideline. "The way we are operating is different from the way Central Research Laboratories normally carry on," admits Harold H. Hosack, director of CCD imagers and cameras projects.

Actually, TI's camera-making business is not totally new. Since the early 1970s, the lab has quietly been supplying cameras in hope of getting its new video technology into the hands of other researchers both inside and outside TI. The CCD lab sells a variety of TI-made cameras, based on monochrome and single-chip color CCDs. Area array imagers—based on the same virtual phase CCD technology as TI's commercial 1-line sensors—are also being made available in a number of sizes. The lab's 800-by-800-pixel high-resolution CCD array imager, for example, will be used in a telescope aboard the Jupiter-bound Galileo spacecraft, scheduled for launch in the next two years.

Compared with TI's traditional marketing efforts, contact with potential research and development customers is low key. "It is not really an advanced product sampling. It is a provision of advanced technology for research people to use and try to understand the system needs when trying to apply it to real applications," Hosack says. "There is no guarantee that any of the particular devices will evolve into real volume products . . . [but] it makes good technology sense to get the devices into the hands of other labs so they can come up with applications that we have not even thought of yet." **–J.R.L.**

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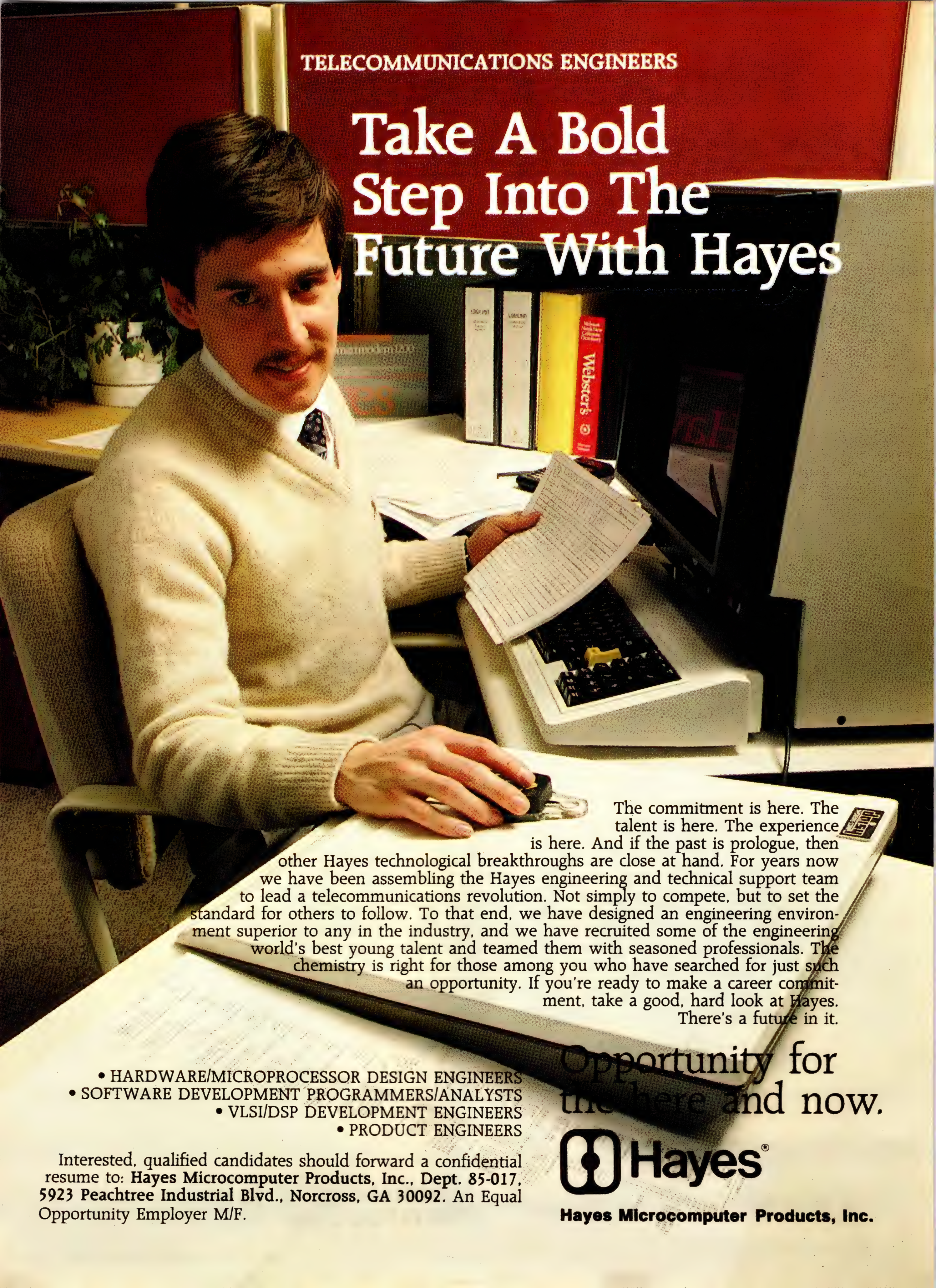

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Analog TV signals from the microcamera enter the TI PC interface module by way of coaxial cable. In addition, the system uses twisted-pair lines for control signals, such as when a frame is shot. The video signals pass through an analog-to-digital converter. Using memory chips with 200-ns cycles, the interface module interleaves the 140-ns converted data into two banks of random-access memory.

Future versions of the board will be able to buffer more than one frame at a time, Gove says. The board also has digital-to-analog circuitry to pass the incoming video signal to a TV monitor, which can be used as a real-time monochrome viewfinder. **–J. Robert Lineback**

INDUSTRIAL

Plato battles fear of statistics

Minneapolis—After a slow, profitless start, Control Data Corp. finally seems to be on solid ground with its Plato teaching programs. Buoyed by positive feedback from sales to such manufacturing giants as General Motors, Cincinnati Milacron, and Allen-Bradley—as well as to educational institutions such as Texas A&M in College Station, Texas—the computer firm is wagering that it can use Plato's methods [*Electronics,* May 31, 1983, p. 145] to teach statistical analysis on the industrial shop floor.

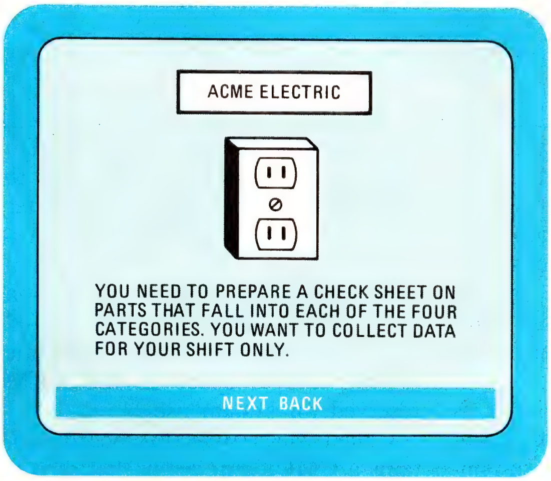
The new program is called SMIP (for Statistical Methods for Improving Performance). When it is introduced on December 15, it will encompass an eight-chapter curriculum designed to train production employees to use statistics to control work processes. SMIP will be "the foundation of a successful new management system—an integrated solution to total quality control," according to William Slabey, manager of Plato Training and Education at CDC.

Math-o-phobia. To implement SMIP, Control Data has teamed up with Concourse Corp., an instructional software firm here, to assuage the worries of math-shy production workers. "With a step-by-step approach—we don't get into statistics right away—the only prerequisite skills are adding, subtracting, multiplying, and dividing, and an eighth-grade reading level," says Slabey. "Even if the worker's skills do not meet these criteria, we have a basic-skills training program to upgrade worker knowledge."

While Jim Bunting, CDC's senior controller for industrial instruction programs, has voiced concern that a term like "statistical methods" may scare some people, he hastens to assure potential customers that SMIP's teaching approach is "so gentle, workers will forget they are dealing with statistics because they'll realize that they're still on familiar ground."

SMIP presents true-to-life situations and illustrates them metaphorically. For example, the idea of randomness is illustrated with the shuffling of a (video) card deck and then related to the quality-control technique of random product sampling to spot possible defects. Further, SMIP comes in different versions (all compatible with the IBM Personal Computer and the CDC-110) so that the on-screen graphics and textual prompts apply to the particular industry where it is used.

"We don't get into chi-squared analyses or linear regression, or anything of that sort," says Bunting.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On-screen stats. A version of SMIP, designed for the electrical industry, prompts workers to use statistical methods to evaluate possible defects.

"Our main focus is to try to impress upon the average production worker the idea that he or she must understand the underlying principles of statistics in order to play an active part in the maintenance of quality control."

Japanese model. Ishekawa's *Guide to Quality Control* (published by the Asian Production Organization) was CDC's reference work when it set up SMIP. The book sets forth the following four principles of mass-production manufacturing:

- Deviation from design specifications is inevitable.
- Problems are the fault of the system, not of the worker.
- Common goals are vital on the shop floor.
- Each worker must have an overview of the whole operation in order to contribute to the production of a quality product.

SMIP addresses itself to these issues by stressing that while no deviation from a specified product design is acceptable in theory, any number of deviations will occur in fact. The essence of quality control is to constantly reduce the frequency and degree of product variance.

Accordingly, SMIP goes beyond keeping manufacturing flaws to an agreed-on level. It has no acceptable variance from a design standard; the program's goal is to cut variance to zero. "Such a goal is impossible in practice," admits Slabey, "but when workers can approach the quality of their output in statistical terms, they will be better able to make meaningful suggestions for improving the overall quality of the finished product." **–David M. Weber**

SOFTWARE

Experts write own programs

Arlington, Va.—Artificial intelligence technology may not find its main market where most people expect it will: AI applications. Instead, AI's biggest sales will come from everday computer use, declares Joseph M. Fox, chairman of Software

Tool maker. Joseph M. Fox sees artificial intelligence's most important role as a tool that lets laymen develop their own software.

Architecture and Engineering, Inc., a supplier of expert-system design products here. "If the AI applications market grows to $9 billion by 1995, as analysts predict, then demand for development tools [using expert-system technology] will reach $90 billion," Fox reasons.

First in line. Control Data Corp., Minneapolis, agrees. Having recently purchased 20% of SA&E stock, the company says it plans to be the first computer maker to offer AI-based application development software as a standard system feature. Next spring, the joint-venture partnership will introduce Spectrum, an upgrade of SA&E's primary product—an applications generator used to construct in-house expert systems.

What convinced CDC to invest in the expert-systems firm and its vision of the future was a simple demonstration, says Fox. In three days, SA&E engineers built a 30-rule expert program for diagnosing crashes in CDC supercomputers. Two months later, a 1,000-rule system had been completed. "Without use of our design tools, the job would have taken about 18 months. That just blew CDC away," relays Fox.

Howard Jensen, CDC's vice president for venture investment, reports that after spending months in search of an AI partner, SA&E emerged "as the premier company in its field, because of its superb reputation with the Department of Defense"—the single biggest user of AI software.

Moreover, CDC believes Fox is zeroing in on the right target. "While most of the industry is focused on robotics and vision, natural languages, and expert systems," says Jensen, "we agree [with Fox] that the biggest AI payoff will be in applications software." Though it's only a $32-million market today, Jensen sees it doubling annually for a long time to come. SA&E, whose sales are currently in the $4 million a year range, is well positioned to grow into a $100 million operation, he adds.

No programmers. With the kind of AI tools Software Architecture is building for CDC machines, the user with no programming skills can design an applications system without the aid of an engineer, explains Fox. For example, instead of an expert imparting his knowledge to a programmer who then takes two to five years to build a system, the expert will sit down at the computer and write the engagement logic (rules stated in an if-then format).

Fox predicts that the inference engine, the part of an expert system that processes thousands of rules to reach a logical conclusion to a query, will usher in the programmerless age. "Inference engines will eliminate the coming shortage of computer analysts because anyone with knowledge in his head will be able to design applications software.

"Indeed, the problem will be an undersupply of logic and cognitive reasoning specialists who can help translate an individual's knowledge into neatly structured rules." Accordingly, applications engineers will recede into the laboratory and concentrate on new support tools that will make self-programming more user friendly.

Inference engines should also produce a shakeout in the custom software industry. Firms such as Computer Sciences Corp., El Segundo, Calif., and Electronic Data Systems, Dallas, should start considering new sources of revenue, Fox suggests, predicting that "10 to 15 years from now, they will be operating in a totally transformed environment."

The only barrier Fox sees to widespread self-programming is that potential users don't know it is possible. But the technological underpinnings are already established. "What we need is for a complex organization like the Department of Defense to prove that it can be done," Fox maintains. SA&E is giving DOD real-life demonstrations, and Fox believes the agency will soon fund a crash program to experiment in such areas as battlefield management.

For now, SA&E is counting on its venture with CDC to catapult it into a new market—from selling to expert system houses to selling to the expert system users themselves. "We will then be in the mainstream of the scientific and data processing community, and we hope to be the leading supplier of inference engines and knowledge representation tools," says Fox. **–Karen Berney**

PERSONAL COMPUTERS

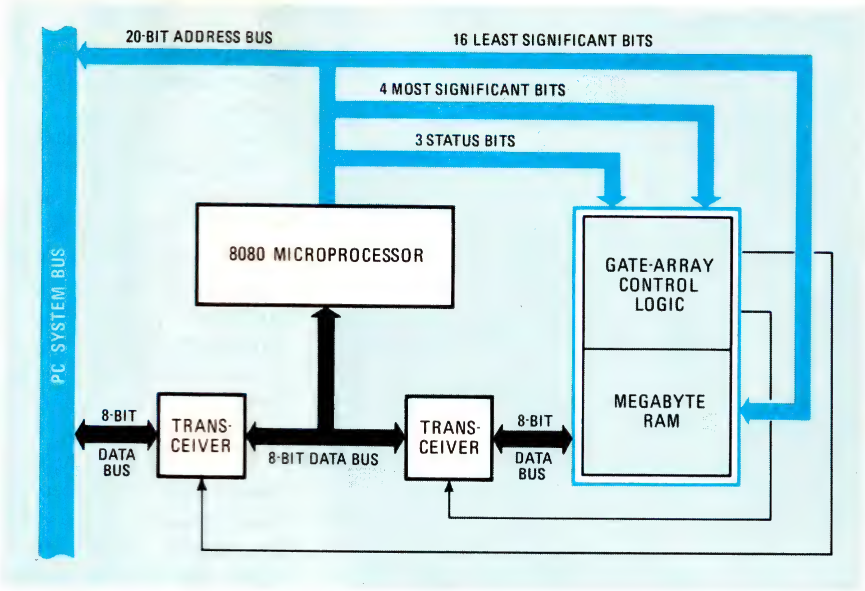
PC add-on board frees up system memory for users

Cupertino, Calif.—The Intel 8088 microprocessor in an IBM Corp. Personal Computer can address better than a megabyte of random-access memory over its 20-bit bus. Unfortunately, that's often not enough for large integrated software programs that must manipulate data from several files.

The reason for the deficiency is that the top 384-K bytes of RAM are reserved for screen and disk control—as well as for other system functions—and thus limit the user to 640-K bytes for programs and data.

To get around the problem, Answer Software Corp., a new Silicon Valley outfit, has designed an add-on board that allows an extra 340-K bytes of memory to share the same logical address space as the RAM reserved for system use.

Called Mega Byte, the board contains a CMOS gate array that directs



Traffic cop. On the Answer board, board and system memory share the same space. Control logic on the board determines which memory will be directed where.

the 8088 to control access either to system memory or to programs and data in RAM. It can address up to a total of 960-K bytes.

The gate array determines which memory is being accessed by reading the four most significant bits in the 20-bit address, and then uses this information to gate one of two transceivers (standard bidirectional bus drivers) that connect the data bus to either the Mega Byte RAM or to the system bus. If the extra memory on the board is not needed for a large program, it can perform the same function as an internal RAM disk, which is a virtual floppy-disk created within the the machine.

This ability is important because 320-K bytes (of an available 640-K bytes of memory) would be used up if an actual double-sided double-density floppy disk were formatted in the standard way. Answer's new board speeds up the process by eliminating the transfer of information to an external floppy; at the same time, it frees up the memory that the transfer would have required.

Design philosophy. Answer Software is a small firm (six employees) that provides program development tools for the IBM PC. In designing its products, the firm learned a lot about the subtleties of PC-DOS, the PC's operating system, says Michael L. Wentz, director of development systems engineering.

The tricky part was in telling PC-DOS that it had more memory available to it, and in what amount, Wentz says. The Mega Byte board holds up to a full megabyte—meaning that all system memory as well as the control logic could fit into a single slot on the PC bus. The board will also work with the PC AT.

Any software that reserves calls in DOS or BIOS (basic input-output system) is 100% compatible with the Mega Byte board and requires no modification, Wentz adds. Some applications programs adress system memory directly, however, and do require a software modification. These include Lotus 1-2-3, Framework, and WordStar.

Ashton-Tate markets Framework, which incoporates word processing and spreadsheet applications. The Los Angeles software firm has written a simple interface for the integrated package that can disable the Answer board as it is writing to the screen but uses the extra memory when it is needed. Answer considers Framework a good target application because it has no virtual memory mode—at least not for now—and keeps all code and data in memory at once, to gain performance.

The CMOS gate array was designed by Answer's engineering vice president, Michael Yen, using an IBM PC and software developed by FutureNet Corp., Canoga Park, Calif., and operating with design rules from S MOS Systems, San Jose, Calif. Simulation and layout were performed on a mainframe, and the resulting layout sent by way of satellite to S MOS's manufacturing partner, Suwa Seikosha, Fujimi, Japan.

Yen says the logic verification and schematic capture took about two weeks on the S MOS system, and the generation of test patterns another six weeks. Answer is expecting the silicon from Suwa Seikosha late this year.

S MOS uses a 2-μm silicon gate process that has less than 2-ns gate delays. The gate-array chip will be used to replace two boards containing 40 low-power Schottky TTL circuits. **–W. Clifford Barney**

CAREERS

The show's the thing for LA job hunters

Los Angeles—That spawning ground of new wrinkles, Silicon Valley, has launched another one. Of special interest to engineers looking for better jobs and companies with openings, the Career Expo offers what amounts to a matchmaking service to bring them together.

It's not an entirely new idea—other industries and colleges have been putting them on in a limited way for years. But such events have become noteworthy because of their speedy rise to popularity among the always-mobile professional labor pool in the California Bay Area.

The latest example occurred earlier this month in Los Angeles, where acceptance of the expos has lagged. A two-day event split between L.A. and Orange County drew nearly 4,000 attendees. Although less than the 6,200 job seekers and recruiters racked up by the flagship show at

Head hunters. Westech ExpoCorp vice president Fred Faltersack and Eva Hogan, technical recruiter for Dalmo Victor Operations of Bell Aerospace Textron, Belmont, Calif., chat during the Los Angeles Career Expo.

San Jose in late September, attendance at this show represents a breakthrough for sprawling Southern California, where it is often hard to turn out people for professional events, says Fred Faltersack, vice president of Westech Expocorp, Santa Clara, Calif., the firm which stages the job shows.

The expos' appeal comes from advantages that are soon becoming apparent to both job candidate and company. "Exhibitor companies are enthusiastic. They see many high-quality people," Faltersack says.

For the individual, there is the chance to explore, at a single site, the opportunities in a given field. Moreover, the quest for a better job can be carried out without revealing identity until the candidate wants to get serious about interviewing.

And for those already at that stage, "where else can an engineer have a one-on-one interview so quickly with the vice presidents or managers who can hire them?" asks Faltersack. He adds that initial misgivings of professionals and companies, who feared career expos might be suitable only for clerks or secretaries, have largely been removed by the results.

For companies, whose only cost is the $2,500 booth fee, the recruiting payoff has been an eye-opener, compared with the other ways to attract engineering talent. The average number of hires stands now at 5.9 employees for each company, according to Faltersack, whose firm keeps precise statistics. By comparison, a large aerospace or electronics company can easily spend many times more on advertising during one week's recruiting drive.

The roster of companies with booths at a Westech career expo includes many of the largest firms, along with start-ups seeking initial employees. San Jose's event had all of its 120 booths sold out 45 days in advance.

The expos' success hasn't gone unnoticed by those quick to jump on a hot trend, says Faltersack. He expects plenty of imitators, some of whom will work both sides. "Headhunters, particularly, might do them to build up their resume data banks—which then are for sale."

His firm now conducts 16 career expos in Northern and Southern California, Phoenix, Seattle, and Denver.

–**Larry Waller**

NETWORKS

Programs trouble French fiber net

Paris—While France's ambitious plan to cable the country with optical fibers is taking physical form, serious questions about its commercial feasibility are being raised because of difficulties in determining just who will supply what content.

The plan of the French Telecommunications and Postal Ministry (PTT) is to establish a number of optical-fiber networks throughout the country that would be operated by the local government, perhaps in conjunction with local industry or utilities. Orders for subscriber connections will exceed 1 million by next year. The operators will buy capacity from the PTT, sell pay TV to subscribers, and collect their fees.

So far, the cities of Montpellier in the south and Paris have signed contracts with the PTT, and installation of their networks is under way. So, too, are two other localities in the Paris suburbs. But what is far less clear is what kind of programming they will be selling, and where it will come from. For this reason, other localities are reportedly in little hurry to sign contracts for their own networks.

One obvious source of content is TV from other countries. Neighboring Belgium and Switzerland both have French-language programs that could be generally broadcast, but going beyond those neighbors would mean bucking linguistic and cultural barriers. "Of course you could show the BBC in St. Cloud"—a Paris suburb with a principally professional population—"where most people speak English, but in working-class areas people just aren't interested," admits Camille Veyres of the PTT's video communications delegation.

To make the situation even stickier, next month France will see the launch of Canal Plus, a pay-TV channel that will be offering—by coded very high-frequency broadcast—films, concerts, and sports events 24 hours a day, seven days a week. At a rental fee of about $16 per month, this service will be a direct competitor to any programming on cable.

Better choice. The PTT thinks that the technological choices they have made in designing the network will serve to distinguish their network from a standard program-distribution service. Unlike tree and branch coaxial networks, which are common in the U.S. but in many cases are running into serious financial difficulty, the French have decided to bet on a switched star configuration that they reckon will significantly facilitate the offering of interactive services.

Such a configuration was used in the country's pilot project at Biarritz [*Electronics*, June 14, 1984, p. 88], currently the world's largest interactive optical-fiber network. Thus, the networks to be installed throughout the country will be constructed with central nodes that will house the main switching equipment, plus antennas for satellite reception and videotape recorders, video disks, and videotex servers. Transmissions will be carried by 80 fiber cables to local addressable hubs.

Subscribers, who each have an in-

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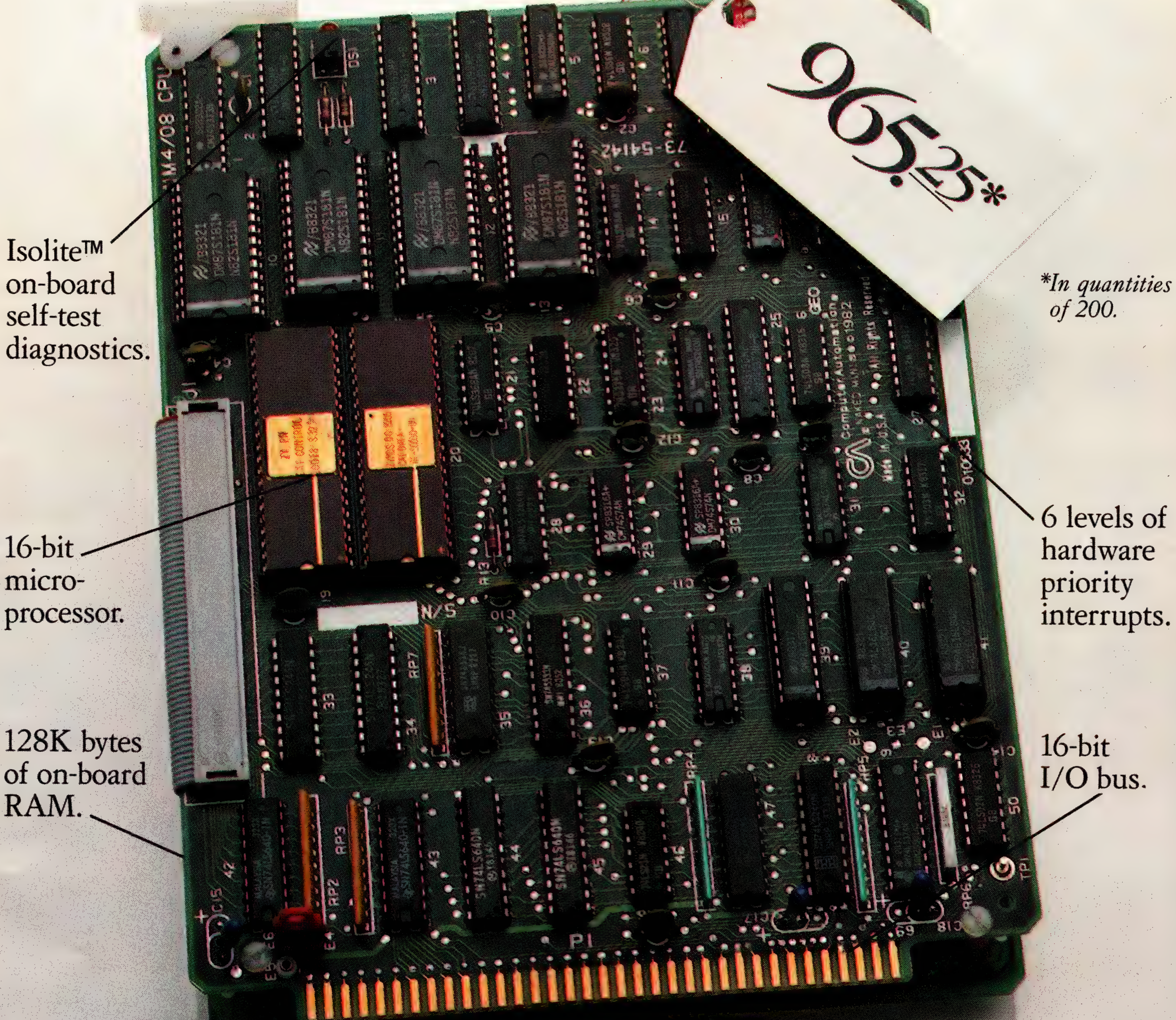
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$CTR_{CE(SAT)}$	150%	225%	350%	250%	100%	120%	60%	75%
I_F	10mA	5mA	3mA	1mA	10mA	5mA	3mA	1mA
t_{PHL}	5μs	12μs	12μs	40μs	12μs	30μs	–	–
t_{PLH}	13μs	8μs	12μs	40μs	20μs	13μs	–	–
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dividual fiber connected to their network socket, are connected to a distribution point that is, in turn, linked to an addressable hub by means of 10 fiber cables. Fibers themselves are dual window: they can carry transmissions at 0.85-μm and 1.3-μm wavelengths. Subscriber transmissions are wavelength multiplexed using five wavelengths in each window.

Despite the uncertainty over programming, PTT officials are convinced that their plan will end up in the black—at least globally. They are betting heavily, for example, on such features as the ability to connect two sets, or one set and a video cassette recorder, into the network in order to give subscribers an edge on standard TV broadcasts, no matter what the content.

PTT officials also expect to create significant traffic by offering access to local picture banks and videotex services. In addition, if Biarritz is any guide, pay-per-view programs and films will attract significant numbers of subscribers. Finally, just having executed the plan will give the French telecommunications industry a leg up against international competition in what they expect to be an expanding market by the end of this decade. –**Robert T. Gallagher**

LASERS

Buried-layer heterostructure laser needs only 4.5-mA threshold current

Harlow, England—Try to integrate several lasers onto a single integrated circuit and the result will likely be a meltdown, as each laser typically needs a drive current of from 15 to 70 mA. But the latest semiconductor laser from Britain's Standard Telephone Laboratories takes only 4.5 mA before it starts to operate.

The significance of this achievement, reported at the recent International Semiconductor Laser Conference in Rio de Janeiro, Brazil, is that it opens the way to new chip structures, according to Daniel Renner, who heads the STL team. Integrated fiber-optic repeaters are one possibility. Another is an integrated laser-detector array to serve as an optical switch in a telecommunications exchange or as a fast logic-element in an optical computer. Laser-detector systems combined with substrate-waveguides could also route signals around a very large-scale IC.

STL researchers have managed to reduce the laser's threshold current by confining the active lasing region to a single filamentary zone measuring just 1 by 0.2 by 140 μm. To form such microscopically proportioned regions, STL researchers have exploited a recently discovered effect called mass transport. The effect was first studied two years ago at MIT's Lincoln Laboratory and at the California Institute of Technology, Pasadena, where it was also used to develop laser-diode structures.

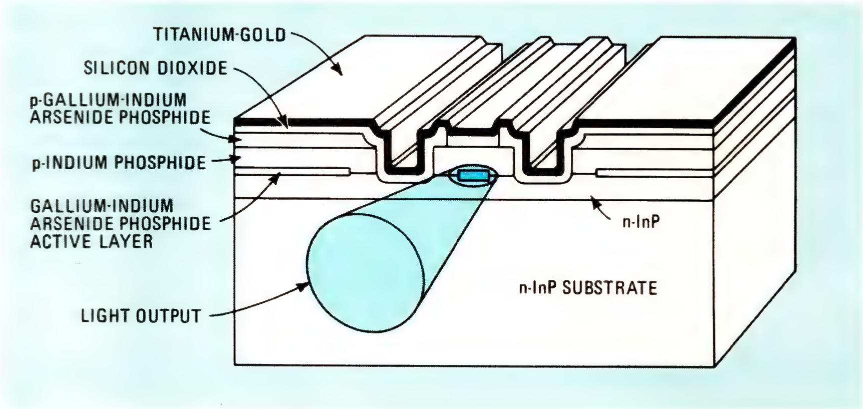
In the STL set-up, mass transport occurs as a hydrogen-halogen gas flows, under pressure, over the semiconductor wafer surface; semiconductor material is transferred from convex or high-spot regions and deposits in concave regions. The effect is analogous to the shift of sands on a beach, although in this case the erosion and deposition is a function of surface energy.

"We decided to develop our own process," says Renner. "We added iodine to the atmosphere to help move the semiconductor material around. As a result, the process works at reduced temperatures—600°C to 680°C—and process times." But mass transport is only used in one critical stage, points out Renner. First, it undercuts the mesa diode structure, thinning down the active gallium-indium arsenide phosphide layer to a width of just 1 μm. Then, the resulting cavity is filled in by mass-transported indium phosphide. For the rest, the fabrication process is fairly standard (see "Mass transport takes lasers for a ride," p. 37).

The InP is of a different refractive index than the active region and so forms a waveguide structure confining the intense laser radiation. Also, the InP regions form forward-biased junctions at either side of the active region and thus confine the stimulating current. The result is a an improved GaInAsP-InP mass-transport-buried heterostructure (MTBH) laser with "excellent operating properties," says Renner.

Low threshold current. STL's new MTBH chip operates at the 1.3-μm wavelength optical window and can have a threshold current as low as 4.6 mA at room temperature and a differential quantum efficiency of 41% per facet. The lasers can operate at up to 120°C because of their low operating current and low contact resistance to the quaternary active layer.

Lasers with an active region 2 μm wide have operated in a stable single lateral mode up to 35 mW. The laser uses a simple Fabrey-Perot cavity, but a distributed feedback version is also under development for high spectral-purity applications. STL is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LIGHT OUTPUT
n-InP
n-InP SUBSTRATE

Cool. STL's buried-layer lasers will operate at temperatures up to 120°C because of low operating current and contact resistance to the quatenary active layer.

now working on plans to transfer the technology to its sister plant in Paignton, Devon, and expects to see first samples by the middle of next year. –**Kevin Smith**

Mass transport takes lasers for a ride

Fabrication of Standard Telecommunication Laboratory's low-threshold laser diode starts with an n-type indium phosphide substrate. A four-layer sandwich is grown on top for improved contact and continuous wave performance, using conventional liquid-phase epitaxial techniques. Next, two channels are etched through this capping layer, thus defining a central mesa structure.

Only now does fabrication depart from the conventional. Mass transport is used to undercut the active gallium-indium arsenide phosphide layer till it is reduced to a width of 1 μm. The mesa structure now has a mushroom-shaped cross section. The resulting cavity is filled in by mass-transported InP. This forms a waveguide structure that confines the drive current to a thin filamentary zone. Next, a protective silicon-dioxide layer is grown over the wafer surface and windows etched in it to accept contact metalization. **–K.S.**

DISTRIBUTION

Distributors' sales dip in third quarter

Los Angeles—On their way to a record year, U.S. component distributors have run into much choppier going than they expected as recently as several months ago. Results of this bellwether business during the calendar third quarter, in fact, look to be somewhat lower—perhaps 5%—than the very strong second quarter, based on the opinions of distributor officials. (Most firms have yet to report third quarter results.)

While distributor sales remain at very high levels—compared with 1983, when the recovery from the recession was still in its early stages—the interruption in growth holds more significance that just a slight sales decrease, industry sources say. The reason: in a business predicated on continuous expansion, and whose inventory, personnel, sales, and financial plans reflect this, any surprise can undermine this business strategy, resulting in a disastrous effect on profitability.

Because distributors in general anticipated only a normal, and temporary, sales slowdown during the summer, questions are now being raised in executive suites and in financial markets about how long the soft demand will last.

Another cause for concern is the industry's slumping book-to-bill ratio. According to recently released figures from the Semiconductor Industry Association, the distribution industry's third quarter ratio stands at 0.84:1. Further, leading semiconductor companies Motorola Inc., Chicago, Ill., and Intel Corp., Santa Clara, Calif., reported sizable gains in earnings for the third quarter, but the figures fell short of expectations.

Setting the tone. As it often does, industry leader Avnet Inc., New York, whose Electronics Marketing Group has some $1.6 billion in annual sales, set the tone for the sector. In a late-September speech to New York financial analysts, chairman Anthony R. Hamilton revealed that its summer quarter would not match 1984's earlier sales pace.

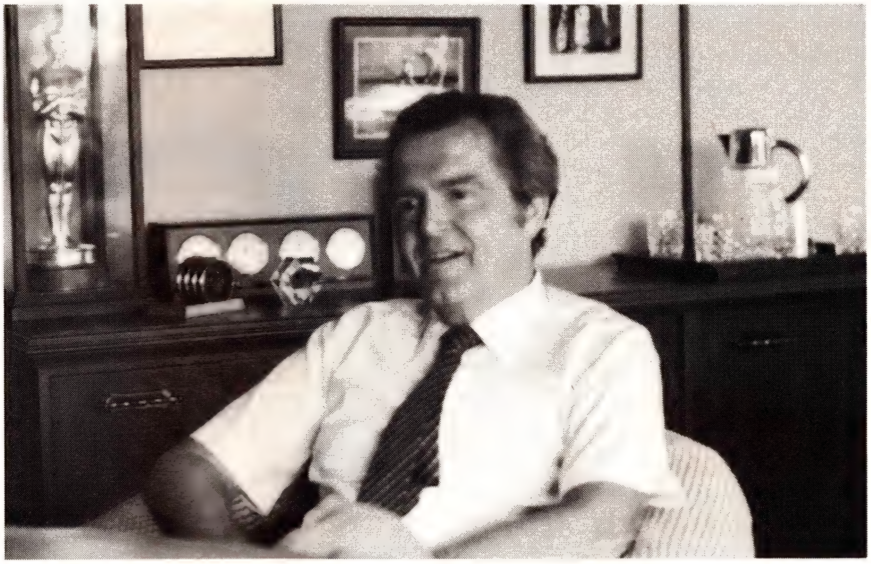
"September business has not yet come up to expectation," Hamilton told the analysts, adding that Avnet has "prepared alternative plans in the event of further sluggishness, even a possible downturn." He blamed the combined effects of a typical summer slowdown and softening of the personal computer business for creating an unexpected increase in the availability of some semiconductor products and, hence, an inventory imbalance.

"The combination of these events has put pressure on customers and distributors alike to adopt a more cautious stance with respect to parts inventories," he continues.

Wall Street reacts. Analysts and investors were quick to react negatively to the news; after a few weeks, they had sold off Avnet stock so heavily that more than 20% of its market value was erased. Other distribution firms suffered accordingly, as the Avnet results generally were interpreted to mean that dramatic growth is slowing, and future gains will be tougher to obtain.

Distribution officials agree that the slowdown stems largely from the sharp dropoff in the manufacture of personal computers, which turned good business into a boom, and from fewer peripherals being built to serve them.

Industry consultant In-Stat Inc., Scottsdale, Ariz., predicted such a scenario in an August industry re-



Cautious. Avnet's Tony Hamilton has set up contingency plans in the event that the dip in components distribution registered in late summer drags on for the next few months.

port, at a time when many distribution officials were playing it down as a temporary occurrence. Moreover, In-Stat's Jack Beedle noted that "many distributors have had to make radical inventory adjustments to compensate for this softness." Such adjustments are continuing, many believe.

No noticeable upsurge. As for fourth quarter business prospects, it is still too early for a definitive fix, but few have yet noted any important upsurge, other than seasonal buying increases from military, industrial, and telecommunications customers. The present outlook for the remainder of 1984: down to flat, according to Charles M. Clough, president of Wyle Laboratories' Electronics Marketing Group, Irvine, Calif. The most notable development is "the dramatic return to availability of all semiconductors," he says.

A more sanguine view is held at Bell Industries Electronic Distribution Group, Sunnyvale, Calif. "While lots of cancellations are going on, it is encouraging that the trend is up," says Howard Franklin, president. He still expects a fairly good quarter.

Stephen Kaufman, president of Arrow Electronics Inc.'s Distribution Division in Melville, N.Y., says Arrow's third quarter sales were down 4%. "I don't think it's a recession," he says, referring to third quarter figures. "It's a stabilization of a growing industry." Holidays observed during the fourth quarter, particularly the week between Christmas and the new year, will wipe out three to five selling days. Kaufman notes this could reduce projected 5% industry growth during the fourth quarter.

For its part, In-Stat is sticking with previous U.S. distribution projections, calling for a fourth quarter that nearly returns to the second quarter level of $690 million. But Beedle observes that the surging growth, of nearly 50% for the entire year, was achieved largely in the first six months. **–Larry Waller**

FIBER-OPTIC SENSORS

Sensor industry poised for a future of certain, if unmeasurable, potential

West Haven, Conn.—Ten to twenty U.S. companies, most of them small, are now manufacturing fiber-optic sensors, which are especially useful in hostile environments where photoelectric equipment can't function properly. No one is certain how the market will shape up, but makers foresee a promising future. "The market's starting to move now. It will be $200 million to $1 billion in 1990, depending on who you believe," says David Krohn, president of Eotech Corp., with a sigh of relief.

Fiber-optic sensors range from simple switches for temperature and pressure applications and limit switches, which sense the absence or presence of something, to highly accurate physical property sensors, such as those used in chemical analysis. Along with being immune to electromagnetic interference, the sensors don't conduct electricity, are smaller and easier to install than photoelectric sensors, and have no moving parts.

"The worse the environment, the more attractive fiber-optic sensors look," says Krohn, pointing out that they can stand up to steam and high vibration. The sensors are used, for example, in semiconductor plants, submarines, and offshore platforms. Being lightweight, they work well in sensitive places, such as on the end of robot arms.

Sees potential. Eotech Corp. president David Krohn believes the market for fiber-optic sensors may reach $1 billion by 1990.

Optimistic, too. Like Krohn, who will speak on sensors at the Instrument Society of America's conference in Houston, Oct. 22-25, Walter N. Damuck, sensor product manager for Veeder Root Co., Hartford, Conn., sees a market worth hundreds of millions of dollars in 1990. Francis Kafka, spokesman for Honeywell Inc.'s Micro Switch Division, adds "We're optimistic, too."

Micro Switch is preparing to introduce two sensors that will be part of its Sensor Interface Device [*ElectronicsWeek,* Oct. 8, 1984, p. 38]. The device is used in such locations as grain elevators to detect the position of automatic equipment and for sensing toxic fumes, especially where sparks from electrical equipment would be dangerous.

Dolan-Jenner Industries Inc.'s limit switches, which do such tasks as checking bottles for missing corks and circuit boards for components, generate about $1 million a year in sales, a figure growing at 10% to 15% yearly, says Seymour Futran, sales and marketing manager.

At Battelle Columbus Laboratory, an independent research organization located in Columbus, Ohio, principal scientists Stewart Kingsley and Anthony Boiarski are working on integrating thousands of discrete sensors into one system. The two say it is possible to do this type of sensing over distances up to 10 kilometers.

Potential applications include stringing the cable along the members of a bridge to monitor stress or burying it underground to warn of intruders. "It's like sending a pulse down a cable and monitoring what comes back," says Boiarski. The system could be in commercial use in two to five years.

For the sensors to be accepted commercially on a wide scale, makers admit they must educate customers and make the devices easier to install and repair in the field. Micro Switch's Kafka has observed people trying to screw the fiber-optic sensors in electrical contacts. Says

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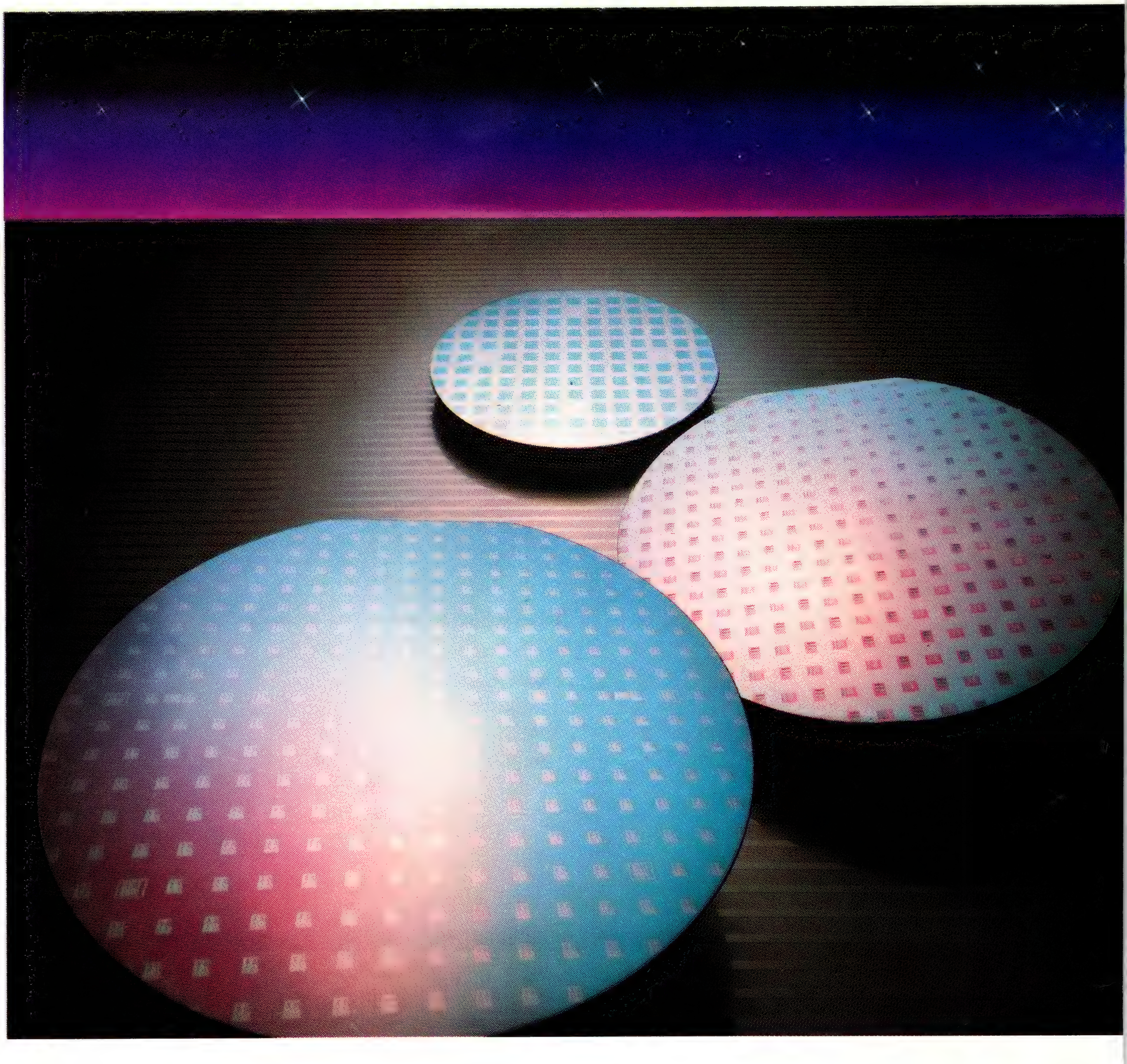

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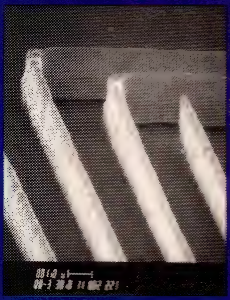

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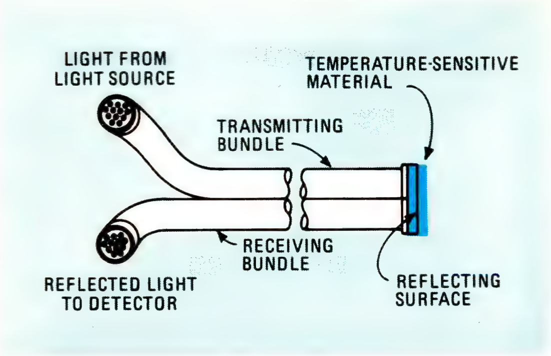


Safe. Fiber-optic probes, like this temperature measurement device, are gaining popularity, especially in hazardous industrial environments.

Krohn, whose firm conducts training seminars, "We need to make it so you don't need a team of PhDs to install them."

Because the industry is in its infancy, it has a multitude of needs but few standard products. Thus, sensors must be developed as individual requests are made. While Eotech is overwhelmed with inquiries, it has a hard time determining which opportunities will be worthwhile—considering that the type of light, configuration, and the working parameters of the probe must be individually specified. "It's a technologist's dream and a businessman's curse," quips Krohn.

Krohn won't disclose sales figures of Eotech, which makes glass fiber, cable, assemblies, data links, and sensors for use in industrial plants and for military communications sensing equipment. He does say, however, that "it's a good business opportunity." It's so good, in fact, that the company could double its staff before 1986. As an example of a situation that cranks up his optimism, he says, "The textile industry has said there's 40 million points going unsensed because they can't get sensors to solve their problem." **–Steve Haggerty**

PERSONAL COMPUTERS

Epson's PC-compatible computer soon to hit U.S. market

Torrance, Calif.—A flawed strategy may have evolved in the marketing of personal computers. The conventional wisdom is to target that 5% market niche that purportedly falls between behemoth IBM Corp. and Apple Computer Inc. But that approach could be wrong.

Breaking in. Epson hopes to break into the U.S. personal computer market with a feature-laden product that is compatible with the IBM PC.

The crowd of U.S. and Japanese firms that tried, and failed, underscores how tough the competition has grown. Now, another entry is stepping up to the plate with a new personal computer that offers a plethora of popular hardware and software features, backed by a well-financed production and promotion program.

The QX-16, to appear in January, comes from Epson America Inc. The parent company in Japan already has several portable computers and an 8-bit desktop unit, the QX-10, for sale. But the new microcomputer represents its most ambitious U.S. computer undertaking yet.

The QX-16 uses both the Intel Corp. 8088 and Zilog Inc.'s Z80 for 16-bit and 8-bit operation to make use of existing operating systems and application packages. Furthermore, Epson officials are forthright in their goal of providing compatibility with IBM Corp. Personal Computers. To this end, Epson designers added a video emulation board to the QX-16, with 128-K bytes of extra random-access memory.

Another feature touted by Epson is a choice of three operating systems—MS-DOS, CP/M, or an updated version of its own Valdocs 2, one of the first integrated software packages. To accommodate the three systems, a special keyboard provides an upper row of function keys that can be defined either for MS-DOS or CP/M by inserting an underlay. With Valdocs (whose earlier versions on the QX-10 reportedly had many bugs), key commands are activated with a single keystroke, according to the company.

For standard hardware, the computer has 256-K bytes of RAM, expandable to 512-K bytes, and dual 5¼-in. disk drives with up to 720-K bytes per disk. This is nearly twice the storage capacity of most of its competitors, Epson officials say.

Other standard features include three extra expansion ports for modem, hard-disk drive, and peripherals. The Valdocs package contains a spreadsheet integrated with business graphics and electronic mail.

Hard sale. Epson officials, while enthusiastic about the new entry, harbor few illusions about ease in cracking the U.S. market. "It will be very difficult," observes Ichiro Hattori, Epson chairman. But he also points out that Epson has a strong market position, selling nearly 40% of the printers for small computers. Moreover, the firm has a U.S. distribution network of about 1,000 outlets suitable for selling computers, the lack of which hampered efforts of other Japanese firms in cracking this business.

Further, Epson regards the QX-16 as merely one step in an effort that "will be more like a marathon race for the remainder of the decade," according to Jack Whalen, who as executive vice president and general manager of the Consumer Products Division is directly responsible for moving the small computers.

Computer industry consultants who attended the QX-16 introduction earlier this month generally withheld opinions on prospects for the Epson machine. "I'm not sure they realize yet how tough this business is," noted a consultant who closely follows the industry.

"Epson had better get its price way under $3,000—and probably close to the $2,000 mark," noted U.S. marketing officials of another Japanese firm who wish anonymity. That's what it will take to crack the U.S. market, they say, since many IBM-compatible units are edging down to that range. **–Larry Waller**

PRESSURE SENSORS

Sensor and signal processing are combined in one package

Hamburg, West Germany—Seeking to overcome the drawbacks of today's semiconductor-based pressure sensors, designers at Valvo, the components-producing Philips subsidiary in this north Germany metropolis, have come up with a sensing device that combines the sensor proper and its output signal processing circuitry in the same package.

The prize for this development effort is a semiconductor pressure sensor that is highly temperature-stable. What's more, with the trimming done by automatic processes during device fabrication, the user is spared the job of component trimming.

Another benefit is that the new devices are interchangeable without the need to individually match them to a particular system. Furthermore, they lend themselves to mass fabrication techniques, "and that should result in a good cost-performance ratio," points out Walter Conrads, sales and marketing manager for semiconductor components at Valvo.

A breed apart. The advantages of what Conrads calls second-generation pressure sensors set them apart from first-generation types. The latter come as discrete or separate sensors whose output is externally processed and, after analog-to-digital signal conversion, fed to a microprocessor, for example, for further signal handling. Because of a discrete sensor's high temperature dependence and the tolerance spreads in its fabrication, extensive trimming by the user is often needed. This can be costly, Conrads says.

With Valvo's second-generation versions combining the sensor and signal processing in the same package, the sensor output is operated on directly, and good thermal coupling is achieved between the sensing and the signal-processing parts. The result is a temperature stability that ensures a correlation between pressure and output voltage of within 2%, over a range from 0°C to 85°C. The devices also have a fast sensor reaction time, responding to temperature variations in 5 ms.

Valvo's second-generation packages will come in two versions. One will have a monolithic pressure-sensing resistance bridge placed next to the integrated signal-processing circuitry. The other will have a thin-film resistance bridge, on top of which is the signal-processing integrated circuit.

In both versions, the metal thin-film trimming resistors for adjusting the offset sensitivity and temperature dependence are on top of the IC. The latter is a bipolar IC that integrates a preamplifier, a current limiter, and an output stage, among other devices, onto an 8-mm^2 chip. The sensor-processing combination is housed in a 6-pin package.

A laser with a 5-μm beam diameter is used to trim the thin-film resistive elements. Coarse trimming is achieved by cutting a slot that is transverse to the element, in effect narrowing the resistor. Fine trimming is done by a slot running parallel with the element's length.

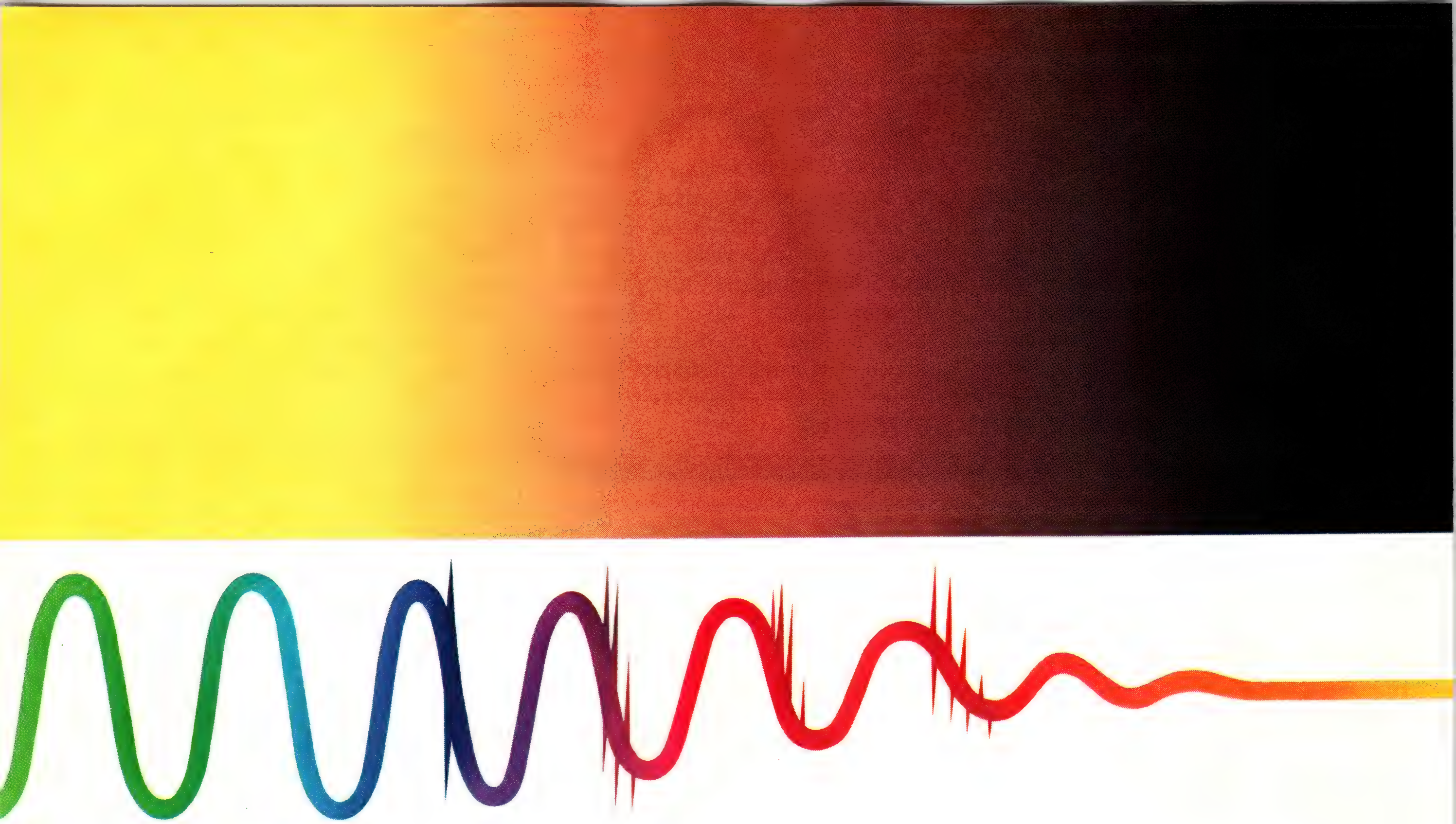
While the company is preparing to introduce its second-generation pressure sensors to the market early next year, "we are already investigating third-generation types," Conrads says. These will combine not only the signal-processing circuits but also the analog-to-digital converter in the same package. This combination would then communicate with the microprocessor by way of a digital data bus. **–John Gosch**

Pressure-sensor market soars

With its second-generation pressure sensors, Valvo, the Philips components-making subsidiary in Hamburg, West Germany, is advancing into a market that is growing by leaps and bounds. According to market forecasters in the UK and West Germany, worldwide sensor sales will come to between $1 billion and $1.2 billion next year.

In that market, semiconductor-based sensors will play an increasingly important role because of their high reliability, sensing accuracy, stability, low weight, small dimensions, insensitivity to the environment, and low price. Their share of the total sensor market should rise from 5% in 1982, to 20% in 1987, and then to 40% in 1992, according to Walter Conrads, sales and marketing manager for semiconductor devices at Valvo.

Although most sensors sold worldwide are of the temperature-sensing variety, they rank second—behind pressure sensors—in terms of value. This results from the latter's higher price and their ability to determine physical parameters other than just pressure—force, for example. Of next year's worldwide sensor market, pressure sensors will account for 39%, temperature sensors for 25%, position and motion sensors for 13%, and other type sensors for 23%. As for areas of application next year, Conrads says, automobiles should claim a share of 49%, household appliances 27%, measuring and control equipment 14%, data and communications equipment 5%, and entertainment electronics also 5%. **–J.G.**



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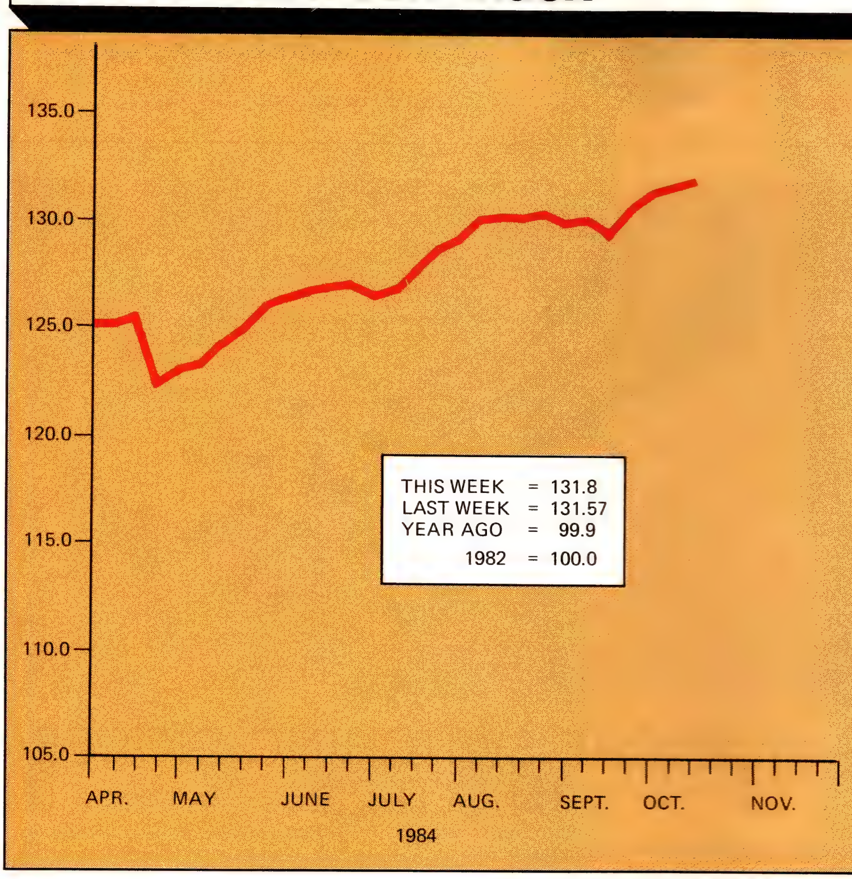
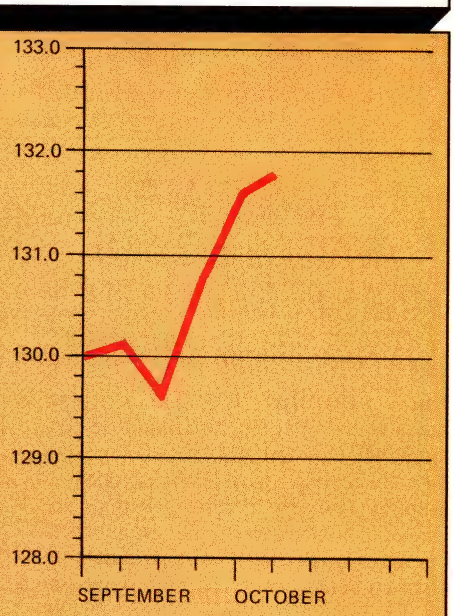
Circle 44 on reader service card

ElectronicsWeek Index





The ElectronicsWeek Index, a seasonally adjusted measure of the U.S. electronics industry's health, is a weighted average of various indicators. Different indicators will appear below from week to week.

U.S. INDUSTRIAL PRODUCTION INDEX

Production workers (thousands)	August 1984	July 1984	August 1983
Office and computing machines	203.9	205.4	195.3
Communications equipment	285.4	284.7	243.0
Radio and TV receiving equipment	64.0	63.6	59.6
Components	426.7	418.5	361.6

U.S. GENERAL ECONOMIC INDICATORS

	August 1984	July 1984	August 1983
Average prime rate (%)	13.00	13.00	10.89
Retail sales ($ billions)	106.232	107.142	98.277
Unemployment rate (%)	7.4	7.4	9.3

The nearly imperceptible rise in the *ElectronicsWeek* Index during the latest week reflects the sleepy economic situation at summer's end. The prime rate remained at a 13% plateau, retail sales dipped almost 1%, and nationwide, the same number of people working in July were working in August.

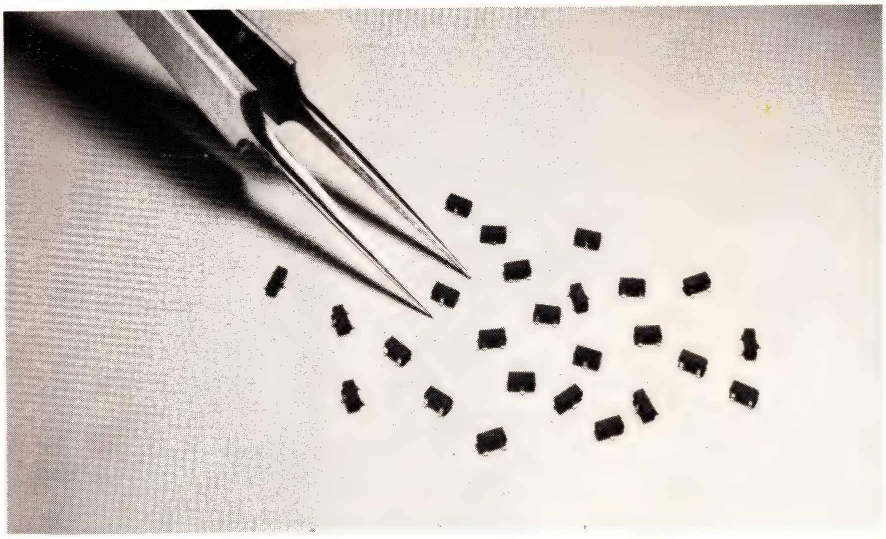
Indicators within the electronics industry also showed signs of weakening. Firms that beefed up production payrolls in step with the vigorous expansion earlier in the year have become more hesitant in hiring. Office and computing machine manufacturers, after adding to production ranks in hefty increments month after month, trimmed their labor force by 0.7% in August.

NEWS FROM

IMMEDIATE AVAILABILITY OF HIGH PERFORMANCE (45/55 ns) 16 K PROMS

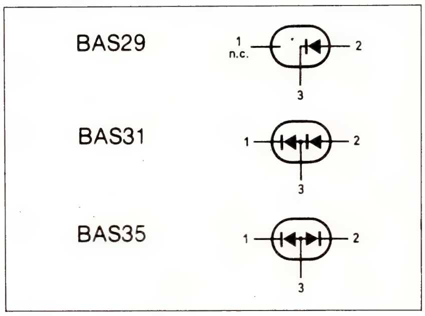
The 82S191A and 82S191B are high performance 16K programmable read-only memories that can dramatically increase memory access speed in microprocessor systems. The new integrated circuits are immediately available in volume quantities; introduction at this time is expected to alleviate shortages in the current market for 16K PROMS. The 82S191A and B have a 2K8 bit configuration and are pin- and function-compatible with the established 82S191 PROM. However, with a maximum address access time (t_{aa}) of only 45 ns for the 82S191B and 55 ns for the 82S191A, the new PROMS are 30 to 40 % faster while maintaining the industry standard pin organization. Current consumption is 185 mA maximum. They are made with the well established nickel-chromium fuse technology and operate from a single 5 V power supply with a typical power dissipation of 775 mW. The new ICs are supplied in 24-pin DILs; the A versions are available in 0,6" wide packages and the B versions in 0,6" or 0,3" wide packages. Operational temperature range is 0 to 75 °C. Military versions are also available, designated the RB82S191A and RB82S191B, with t_{aa} of 70 ns and 60 ns respectively. The temperature range for these versions is −55 to 125 °C. Volume quantities may be ordered immediately in several package and temperature range options.

CIRCLE 250 ON READER SERVICE CARD



AVALANCHE SWITCHING DIODES IN SOT-23

Our established BAX12 high speed planar avalanche switching diode is now available in three different configurations in a SOT-23 microminiature package for surface mounted assembly. They are the single-diode BAS29, the double diode (series connected) BAS31, and the double diode (common anode) BAS35. The double diode types can cut cost and save board space. The crystals for the new diodes are taken from the same production run as the BAX12 so that the electrical characteristics are identical. The fast switching speed of 50 ns makes the diodes suitable for switching loads in semi-electronic telephone exchanges. Maximum ratings are: continuous reverse voltage 90 V; repetitive peak forward current 600 mA; junction temperature 150 °C. The devices are supplied on 8 mm blister tape. They are part of a continuing program to introduce SMA versions of standard Philips diode ranges.



CIRCLE 251 ON READER SERVICE CARD

1300 nm LASER FOR LONG-DISTANCE GLASS-FIBRE COMMUNICATIONS

A new 1300 nm InGaAsP laser is available with two different fibre pigtails; the 502CQF with multi-mode graded index fibre (50 μm) and the 503CQF with single-mode fibre (5 μm). The two buried heterojunction devices are specifically designed for long-distance, high-speed optical fibre communications and data transmission at rates up to 560 Mbits. Thanks to a unique adjustable coupling method, the laser/fibre coupling efficiency is high - up to 80% for the 502CQF and 50% for the 503CQF - ensuring good optical stability over an operating temperature range from 0 to 60 °C. The efficiency of the complete communication system is further enhanced by the low fibre attenuation at 1300 nm. The lasers have a low threshold current of typically 25 mA (40 mA max.) and operate at fibre output power levels of 3 mW (for the 502CQF) and 2 mW (for the 503CQF). Both devices have a fast responding photodiode optically coupled to the rear face of the laser to monitor the radiant output power. The lasers are mounted in a modified SOT-148 hermetically sealed encapsulation.

CIRCLE 252 ON READER SERVICE CARD

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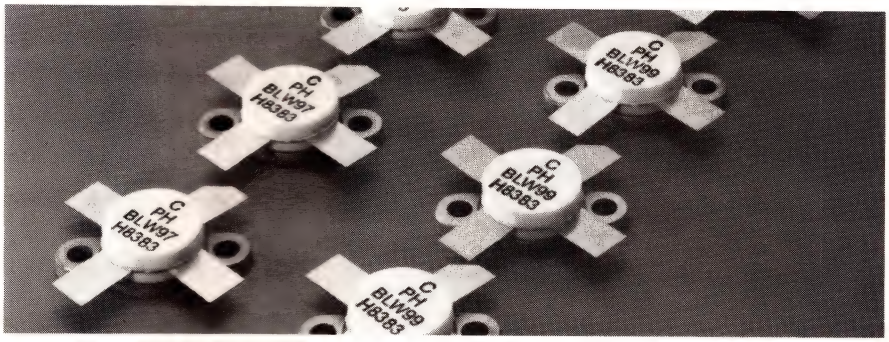
LCD DRIVER WITH I²C BUS INTERFACE CUTS COST AND COMPLEXITY

The PCF8577 is a CMOS silicon gate LCD driver designed to drive up to 32 segments directly or 64 segments in duplex mode. The two-line I²C bus interface substantially reduces the number of interconnections required in remote displays. In addition, the pinning is optimized for single plane wiring thus allowing the use of a single-sided PCB which further reduces complexity and cuts assembly costs. The PCF8577 is for general display applications especially in dashboard panels, instruments and telephones, or alternatively for use as an I²C bus output expander. For systems with several PCF8577s, bus traffic is kept to a minimum by automatic address incrementing across sub-address boundaries. In the direct drive mode traffic is further minimized by display memory switching. The programmable addressing of the PCF8577 allows a maximum of 8 directly-driven LCD drivers to be connected to an I²C bus-based system, thus giving a total of 256 display segments. The operating supply voltage range of the IC is 2,5 V to 9 V depending on the voltage level of the LCD. For the I²C bus there are independent fixed voltage levels of 0,8 V (input LOW) and 2,0 V (input HIGH). The maximum current consumption at 9,0 V with no external load is 250μ A when the bus is operating, and 50μ A max. without bus traffic (no external load). When the power is switched on, a power-on reset circuit blanks out all the segments until data is received by the IC. The new IC is available in two versions: the PCF 8577 in a plastic, 40-lead DIL, SOT-129; and the PCF8577T in a plastic, 40-lead SO mini package, VSO-40.

CIRCLE 253 ON READER SERVICE CARD



VERY RUGGED HF POWER TRANSISTORS

Two new additions to our range of h.f. power transistors for communications equipment, the BLW97 and BLW99, are resistance stabilised to guarantee good performance even under severe load mismatch conditions. The transistors are supplied in matched current gain (h_{FE}) groups to ensure minimum harmonic distortion. The BLW97 has an outstanding output power of 175 W; it is a higher power, 28 V version of the BLW96. The new device is designed for s.s.b. operation in class A, AB and B power amplifiers in civil and military transmitting equipment. The BLW99 is a 12,5 V, 80 W transistor ideal for use in high power hand-held or mobile radio sets. It is also intended for the s.s.b. mode of operation, in class AB and B linear amplifiers. The BLW99 was developed from the well established BLX15 h.f./v.h.f. power transistor. The BLW97 and BLW99 are supplied in a 4-lead flange envelope with a ceramic cap; all leads are isolated from the flange.

	V_{CE}	I_C	Freq.	P_L	G_P	Efficiency	d_3*	d_5*
	V	A	MHz	W	dB	%	dB	dB
BLW97	28	0,1	1,6 - 28	175	>11,5	>40	< -30	< -30
BLW99	12,5	0,15	1,6 - 28	80	>12,5	>35	< -24	< -24

The r.f. performance of the transistors in the class AB mode at an ambient temperature of 25 °C is shown in the table above.

* Intermodulation distortion levels.

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Our latest interference suppression beads are axially wired so that they can be automatically mounted on PCBs by standard automatic insertion machines. The beads are manufactured in Ferroxcube grade 3S2, ideal for the suppression of unwanted frequencies in the 20 to 300 MHz range. Main applications are in power supplies, computers, and radio and television receivers (they can replace wire bridges in digital TV sets), as well as in automotive and domestic equipment. The beads have a maximum impedance of more than 80 Ω at 50 MHz. The beads which measure 6 mm x 3,5 mm are supplied taped together on spools according to IEC286 part 1. The axial wire is tinned copper. Minimum impedances at different frequencies are:

Frequency(MHz)	1	3	10	30	100	300
Impedance(Ω)	5	18	48	70	80	65

Samples are available now, volume quantities can be delivered 3 or 4 months after receipt of the order.

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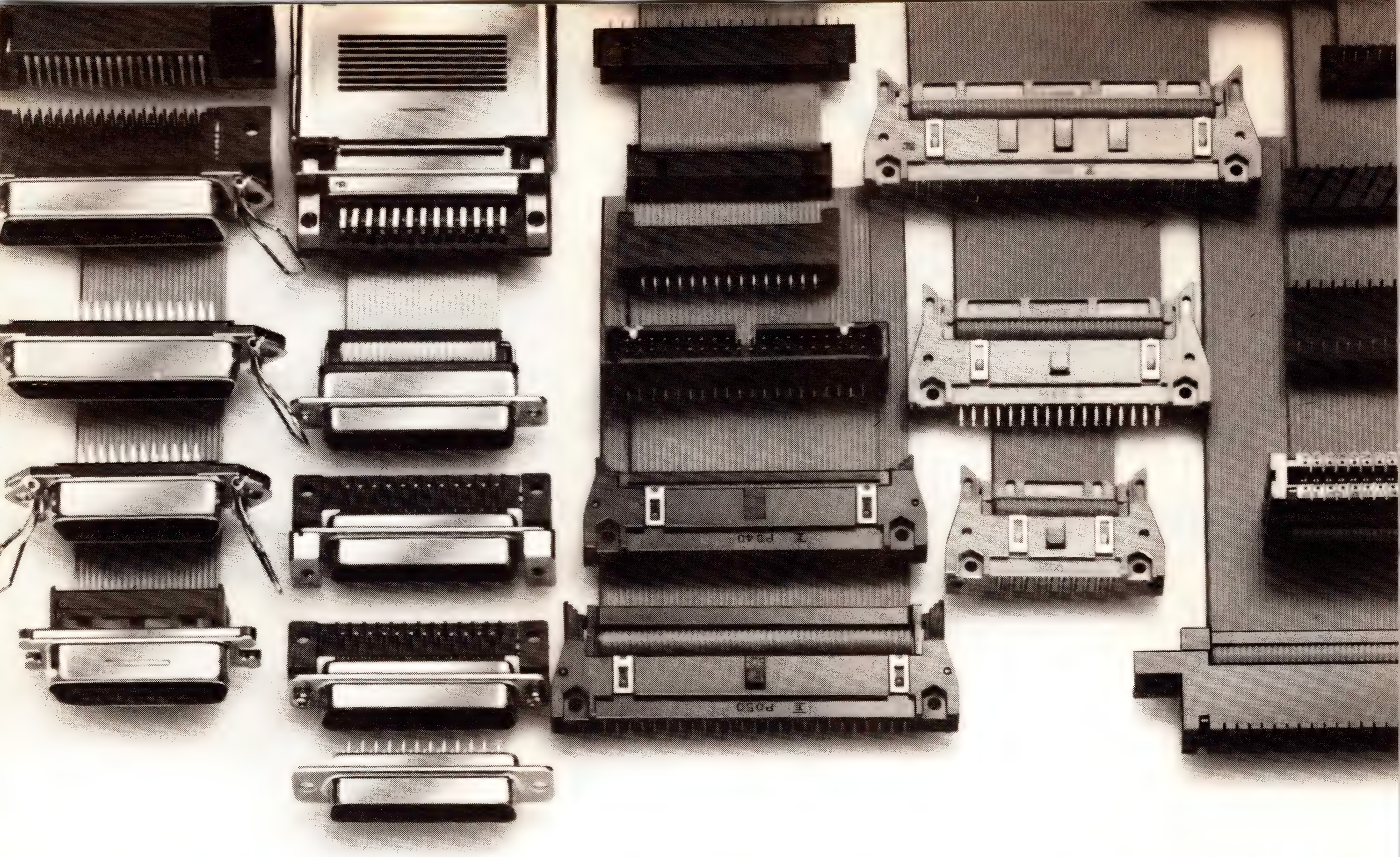

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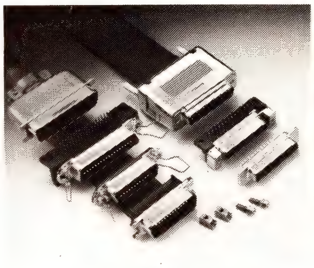
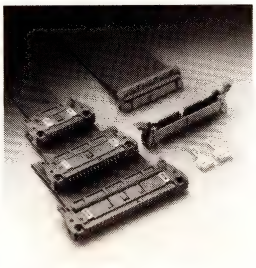


D-type connectors (FCN-770)
Ribbon-type connectors (FCN-780)



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Circle 130 on reader service card

NTIA CHIEF DAVID MARKEY TAKES ON THE TOUGH OPPOSITION

Washington, D.C.

David J. Markey doesn't mind confrontation. As an Assistant Secretary of Commerce and head of the National Telecommunications & Information Administration, he often gets grilled by Congressman Tim Wirth (D., Colo.), chairman of the House subcommittee on telecommunications.

At the Federal Communications Commission, he is often pitted against private interests in his role as defender of the government's view on spectrum use and management. And he is currently at odds with the Department of Justice over the issue of how the recently divested Bell operating companies should be regulated.

"Confrontation is how the government works," says Markey, a 44-year-old native of Frederick, Md., who got started 17 years ago in the Maryland state government. In 1974, he moved into the national arena by taking a seven-year stint as vice president of congressional relations for the influential National Association of Broadcasters.

From there, he went to Capitol Hill to serve as chief of staff to Sen. Frank Murkowski of Alaska. Before his appointment as NTIA administrator in 1983, Markey gained an insider's view of the FCC as special adviser to Chairman Mark Fowler.

No wonder politics doesn't ruffle him. "I just get a good night's sleep and take each day at a time."

A lawyer by training, Markey heads an agency known mostly for its production of technical treatises, but increasingly recognized as a prime mover in setting government telecommunications policy. Stripping away regulation, encouraging competition, and expediting the introduction of new technologies is the essence of that policy, he says.

Along with the FCC and Department of State, NTIA is working on what Markey describes as the "most critical telecom issue today"—the question of whether the U.S. should allow private satellite systems to compete with the global network of the International Telecommunications Satellite Organization. Though the Reagan Administration has not yet disclosed its position, Markey hints that the alternative systems will be allowed to fly, albeit under some restrictions.

Domestically, Markey is most concerned with having the FCC put an end to uncertainty over access charges, the fees consumers and businesses must pay to hook into local telephone exchanges. Second to his heart is resolving the legal questions surrounding the activities of the newly spun-off Bell operating companies.

"The BOCs are large and talented companies that should be able to offer the public more than just basic telephone service," he insists. Hence, Markey has taken on the Justice Department to get it to lift restrictions on the commercial ventures that BOCs can branch into.

Turning to NTIA's technical mission, Markey says his agency is worried about depletion of available radio frequencies. "Simply put, we are running out of spectrum and the only solution is for users to employ more efficient technologies like narrowband fm and amplitude-compandored single sideband," he says.

The Washington veteran doesn't expect to see much progress made until Congress gets involved. "The way it works around here, some congressional district will have to raise the roof because it can't obtain access to spectrum it wants for a new service," he says. **–Karen Berney**

Man in the middle. As national telecommunications czar, David J. Markey has to deal with problems brought about by rapidly changing technologies.

With Thomson besieged, Zanni came, saw the problems, and conquered them

Paris

The man brought in to whip the sales activity of a going, though flagging, semiconductor operation into shape might be assumed to make extensive organizational changes. But when Carlo Zanni took over as commercial director at the Thomson Semiconducteurs Division of Thomson-CSF two years ago, the task was even more daunting: he virtually had to start from scratch.

No one at Thomson, least of all Zanni, hides the fact that the semiconductor group in the past suffered constant, massive losses as a result of both poor production and a weak sales force. According to Zanni's analysis, the flaw on the sales side was basically one of poor orientation, so his first move was to impose a clearer sense of direction.

"What I've done is really quite classic, in that we now have a sales organization that is specific to semiconductors," he explains. "In the past, Thomson had a single organization for the entire components division, and there is simply no way that salesmen can be sufficiently knowledgeable to provide the kind of technical support that a customer needs in subjects as diverse as the integrated circuits, the discretes, the electronic tubes, and the crystals, ferrites, and capacitors that Thomson supplies."

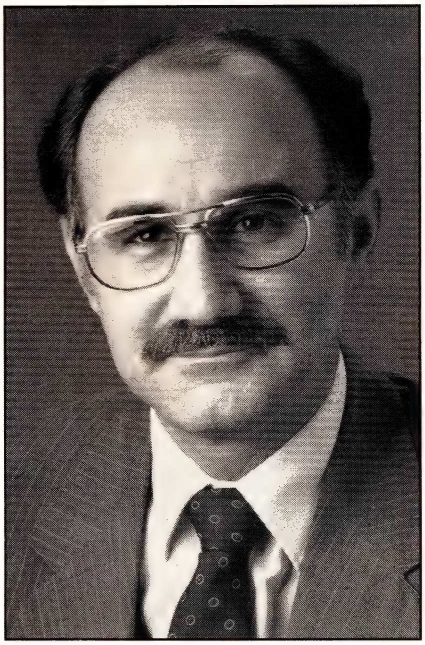
Zanni, 46, came to Thomson from Texas Instruments (France), where he began as a field service engineer. He worked his way up to sales manager and strategic planning manager for the semiconductor division before taking over as sales and marketing manager for the Consumer Products Division.

Already, Zanni's reorganization is bearing fruit. Last year, sales jumped an impressive 53%, just over double the figure for world market growth. And this year the turnover will rocket another 67%, against an estimated 40% for the world market. Such performance, he says with visible pride, puts his team at the level of the sales forces of the best U.S. semiconductor houses.

–**Robert T. Gallagher**

Boosts business. Carlo Zanni's refurbished sales force will boost Thomson's semiconductor turnover nearly 70% this year.

Deverse is positioning IMI for coming gate-array boom



Cashing in. A father of the gate array, Frank Deverse expects to get a billion-dollar hunk of that now-maturing market.

Santa Clara, Calif.

Responding to the market for custom integrated circuits in 1974, International Microcircuits Inc.—led by founder and president Frank Deverse, one of the fathers of the gate array—conceived a chip called the master slice. That was 800 CMOS gate-array designs ago, and now IMI is waiting to pounce on a full-blown gate-array market, which Deverse expects will reach between $5 billion and $20 billion in 1990.

"There will be room for half a dozen billion-dollar companies then," says Deverse, who is positioning his firm to grab a substantial portion of the pie. As part of its plan to achieve an annual growth rate of 40% to 50%, IMI, with yearly sales of $16 million, is seeking an initial $8 million funding from corporate and institutional investors.

"We will probably go public as soon as our company and the market merit it—in '85 or '86," Deverse says. The firm, which did 148 gate-array integrations in 1983, has added sales representatives in Germany, Italy, India, Brazil, and South Korea for its custom and standard gate-array lines, bringing its total of international outlets to 19. IMI also has design centers in Italy, the UK, and France, where customers can participate in design. To help him handle the increased workload, Deverse recently reorganized his staff and made three of his employees vice presidents—for marketing, operations, and international operations.

Tens of thousands. Of the firm's business, 20% is 4,000-gate, military-screened, multilayer gate arrays, of which the company says it has shipped tens of thousands. "The best way to integrate multifunctions—logic, memory, and other functions—is through standard cells," Deverse says, adding that he expects the company's business in this area will grow from 3% of revenues to 60% by the end of the decade .

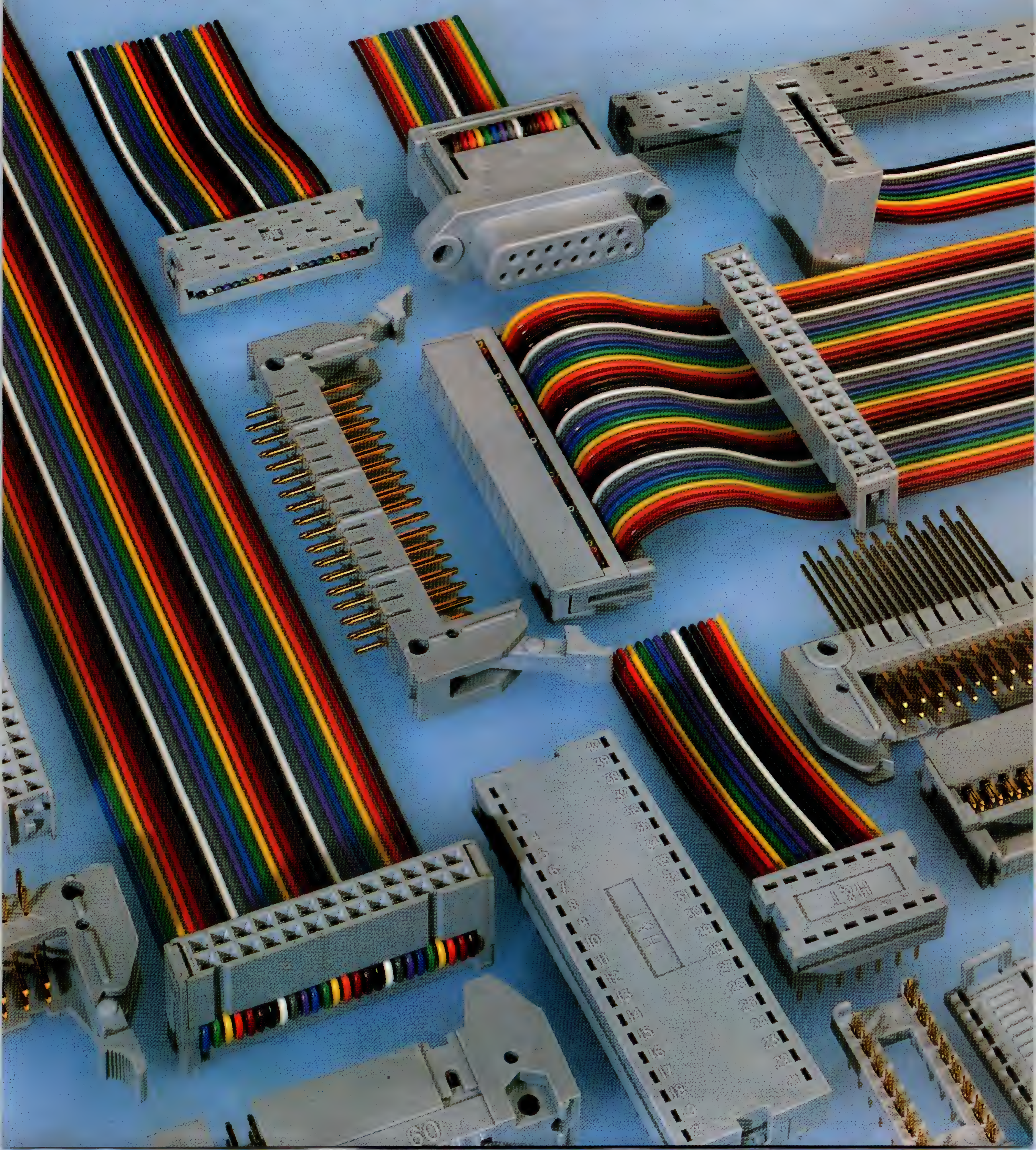
The 47-year-old Deverse holds over 20 patents, most relating to semiconductor processing. He is the pioneer of hexamethyldysalazane, or HMDS, a photoresist precoat used on wafers. Other patents relate to enhancing photoresist and to metal-etching techniques.

A 21-year veteran of the semiconductor industry, Deverse has held engineering and management positions at Fairchild Semiconductor Inc. (now Fairchild Camera and Instrument Corp.), Mountain View, Calif., and IBM Corp., Armonk, N.Y. He received his bachelor's degree in chemistry from Duquesne University, in Pittsburgh.

IMI is the oldest gate-array manufacturer in the U.S. selling to outside customers, according to Deverse, who says his firm also pioneered multilayer interconnection and silicon-gate CMOS, which have helped to increase density and speed. Regarding IMI's early commitment to CMOS, he says, "In hindsight, it was a helluva decision."–**Steve Haggerty**

CONNECTORS

SPECIAL ADVERTISING SECTION

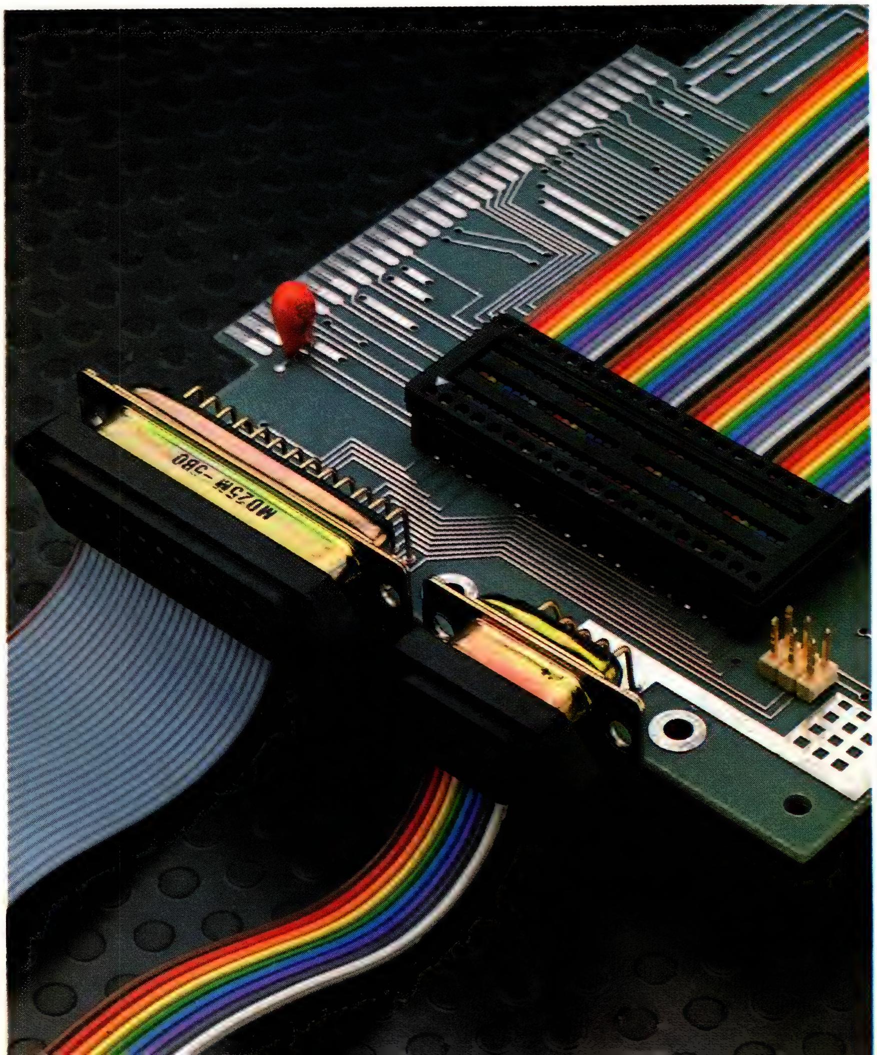


CONNECTOR TECHNOLOGY: AN UPDATE FOR DESIGNERS

Although they are competitors, the connector manufacturers who have contributed to this special section would all readily agree on one point: the more a customer knows about connectors, the better it is for the manufacturer. In that spirit, this report will review the basic connector types, examine a number of today's critical issues in connector and termination technology, and provide some basic guidelines for making a selection. Sprinkled throughout are a number of new and innovative product offerings.

System designers are offered not only a wide variety of connector suppliers from which to choose but a wide variety of connector types or connection systems. For example, cable connectors are used to make connections between a cable and electronic and electrical equipment, machines, panels, printed-circuit boards, and another cable. The fixed cable connector is used for attachment to a rigid surface, while a free cable connector mates with the cable.

Most D subminiature connectors for IDC cable typically are not suited to high-density packaging applications, but Symbex Corp.'s line of D terminators have a low overall front-to-back connector profile, measuring as much as ⅜-in. shorter than competing connectors. Strain relief on the Chico, Calif., firm's connectors is integral. [Circle 440]



Rack and panel connectors are fixed connectors that provide electrical connection between a unit and its mounting rack. An alignment device usually provided insures correct mating.

There are two basic types of pc-board connectors: the edge connector and the two-piece connector. A one-piece receptacle, the edge connector contains female contacts that link with the male contacts that are printed or etched on the edge of a board. Two-piece connectors consist of a mating member permanently attached to the board and another member connected to the equipment. Board thickness, contact spacing, board or slot length, and contact styles are some of the design elements that must be considered carefully with this type of connector.

The International Scene

With the seemingly unending push toward greater packaging densities, the card edge connector—limited to 20 contacts per inch of board space—is giving way to the two-piece box and pin connector. The most widely recognized two-piece box and pin connector system is manufactured to DIN 41612 standards. As the standard connector in Europe for some 15 years, it is being churned out by most major connector companies.

In fact, the DIN 41612 system is the only box and pin connector that provides dependable form, fit, and function interchangeability from one manufacturer to another. This situation has contributed to this type's popularity in the U.S. The market for this connector should continue to flourish, as at least two major bus systems have specified the DIN 41612 standard as the pc-board interface.

Traditional DIN specifications call for the receptacle connector to be

The cover photograph is courtesy of H&T Components Inc.

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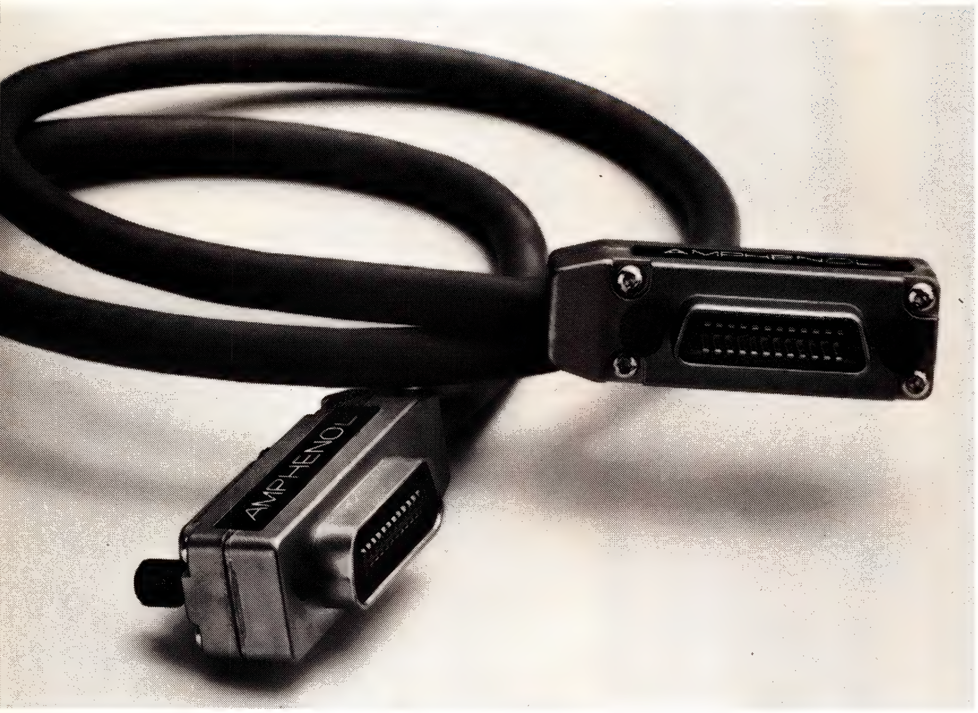


Used for interconnecting instruments, these IEEE-488-bus cable assemblies from Amphenol Products, Oak Brook, Ill., feature double-shielded cable, plus additional shielding around inner layers to minimize crosstalk between control and data lines. The connectors have a die-cast nickel-plated aluminum shell. [Circle 441]

mounted on the backplane and the right-angle 0.025-in.^{2} pin connector to be mounted on the module card. Inverse DIN connectors reverse the male-female role of the connectors, placing the receptacle connector of right-angle configuration on the module card and the 0.025-in.^{2} male connector perpendicular on the backplane. These inverse connectors also allow the user to take full advantage of its repairability features.

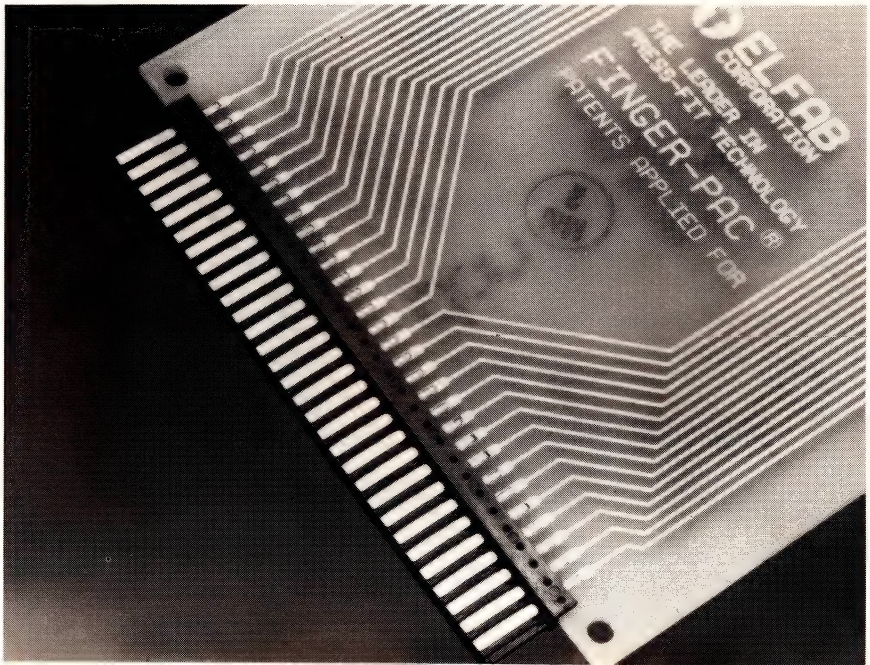
Standard DIN connectors placed end to end on minimum 3.750-in. center lines provide a connector density of 28 pins per inch of pc-board edge. Placing as many as four of these connectors end to end, the maximum overall pin count that can be achieved is 384 pins per board. Custom designs currently on the drawing board and a few that are already being delivered are calling for more than 600 pins on one board. This is accomplished by implementing not three, but four rows of contacts on a continuous 100-by-100-in. grid spacing.

Working with Coax

The coaxial connector's primary job, quite simply, is to attach and decouple coaxial cable. To do this, the connector system must be electrically and physically similar to the cable. Key evaluation criteria used in choosing a suitable connector include physical size, electrical characteristics, coupling method, termination mode, and cost.

Coaxial connectors generally are classified into four categories according to their size: subminiature for use with cables up to 0.150 in. in outside diameter; miniature for 0.150-to-0.350-in. cables; medium for 0.350-to-0.600-in. cables; and larger. Critical electrical characteristics are matched impedance and voltage. Unfortunately, these characteristics are incompatible, and so a user must make performance tradeoffs.

Coupling types for all of these connector types include bayonet, threaded, and quick disconnect. The bayonet type offers speed but generates electrical noise in the circuit if it is subjected to vibration. The oldest and most widely used with low-cost connectors, threaded couplers make a more positive contact than the other two types. However, they tend to loosen with shock and vibration, and they take longer to connect and disconnect. Push-on, or quick-disconnect couplings are ideal for frequent matings and unmatings and where space is at a premium but not necessarily if excessive movement or



This surface-mountable connector from Elfab Corp., Dallas, Texas replaces the traditional printed-circuit-board gold fingers and reduces cost. The Finger-Pac connector simply installs on the board's edge, soldering onto the soldered-plated, etched pads, and mates with the card's existing edge connectors. [Circle 442] necessarily if excessive movement or vibration will occur.

Data links using optically transparent fibers are a rapidly developing field. Fiber-optic connectors must link fiber cables to active devices such as light-emitting diodes or photodiodes. There are three basic classes: bundle, single-fiber, and hybrid.

Bundle connectors terminate fiber-optic cables that may contain many fibers carrying a single message and terminating in a single ferrule. These connectors can be single- or multiple-channel and are best suited for systems with cable runs that do not exceed 330 ft and require stable connections for analog data transfer.

Single-fiber connectors link individual fibers with other individual fibers. They typically are used in data systems with greater than 330-ft runs using digital data transmission.

Lastly, hybrid connectors are composed of both fiber-optic ferrules and electrical contacts to connect a combination of fiber-optic and electrical cable simultaneously. They are used in systems in which both optical and electrical transmission is required.

New Technologies

Electronics technology is advancing rapidly, being pushed by a number of concerns, an important one being conserving space. In some cases, this has led to the replacement of traditional connector systems with new technologies that must be accepted now as interconnection systems.

Chief among these is surface-mounting technology and the role of conductive elastomers. Conductive coatings, paints, inks, and compounds are finding increasing use as connectors. Many organic materials can be made conductive by blending them with the proper fillers. Gold, palladium, platinum, silver, and lower-cost metals are typical fillers. Other fillers include nickel, tin, zinc, and conductive oxides.

For use in burn-in tests and the like, test sockets are an important variant on the connector theme. The test socket consists of an insulator body and electrical contacts. The body materials vary considerably, depending on the environment in which the socket will be used.

Since a test socket must withstand repeated use, the basic contact design and plating are more rugged than those of a production socket body. Several important factors that every test socket user should remember are:

- Low leakage, crosstalk, and capacitive effect between contacts must be considered at switching-speed frequencies.
- At signal-level voltages and amperages, the resistance of the entire contact length must be included in the resistance of the test circuitry.
- The socket's inherent resistance, plus film resistance, tend to increase as the contacts wear and are subjected to repeated burn-in cycles. A moderate typical force of the test socket contact against the device lead is provided. These forces, on the order of 35 to 50 g, usually are enough to break through and counteract any film resistance.
- A periodic replacement program should be introduced, as sockets eventually wear down after a number of burn-in tests.

Whatever the type of connector, a number of concerns—controlling electromagnetic and radio-frequency interference, the choice of a material for the contact surface, and terminating techniques—are universal to all.

Controlling emi/rfi

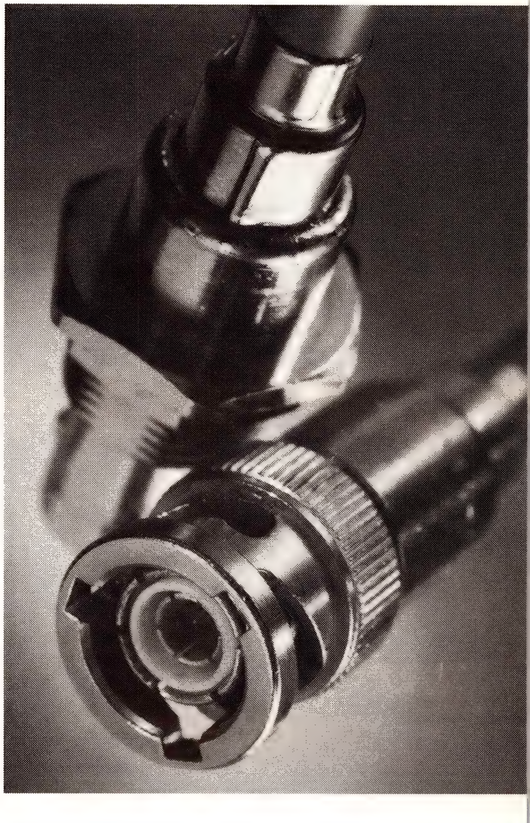
The bane of design engineers from the first days of radio onward, controlling emi and rfi is tougher than ever with the Federal Communications Commission's latest set of regulations, Docket 20780, which sets limits on electromagnetic and rf emissions from computing devices. Moreover, the FCC's definition of computing devices is intentionally broad, including equipment used for computing, recording, storing, and transferring of information. Surprisingly, consumer goods like electronic games and digital telephones fall into this category.

Generally, the regulation covers any piece of electronic equipment that uses or generates pulses (data or timing) that are higher than 10 kHz. Since the timing clocks of most digital systems are set much higher than this, all of them are subject to Docket 20780 regulation.

Since emissions are relative, emi and rfi depends on what is present in a system to begin with. While shielding techniques may work in one system, they may be less effective in another that has different electrical characteristics. To effectively control emissions, many factors must be considered, including the electronic packages and their envelopes, chassis and system grounding, connectors, cables, and the interfaces between all these parts.

Laboratory and field testing have shown interconnecting cabling to be a

No soldering is required to terminate this series of radio-frequency connectors to high-frequency triaxial or twin-axial cables. Crimpable bayonet-lock couplings from Amp Inc., Harrisburg, Pa., provide rugged, low-noise quick connect/disconnect action over a 500-cycle life and display a 100-lb coupling retention. [Circle 443]



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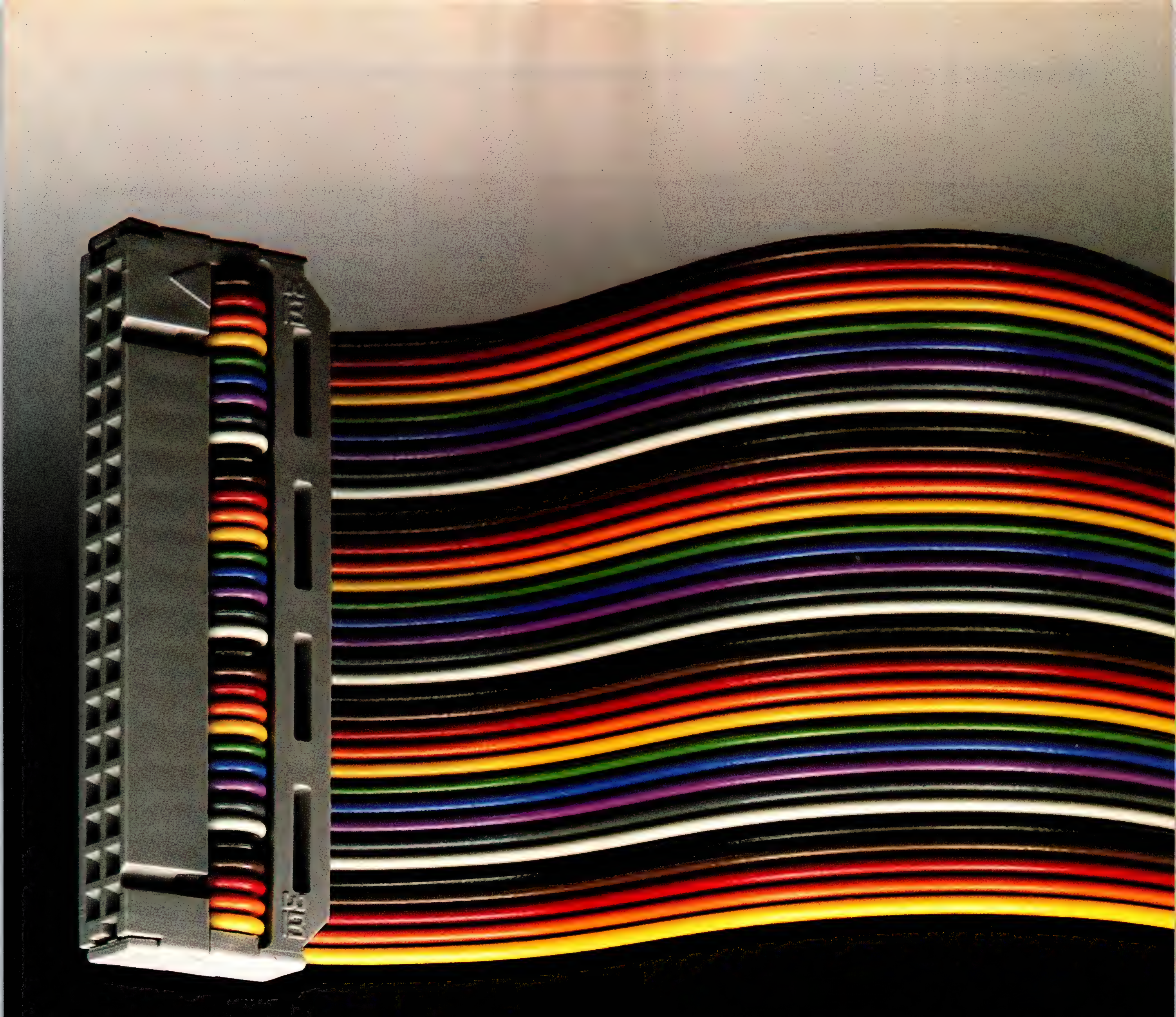

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Circle 57 on reader service card

TABLE 1: CONTACT PLATING CHARACTERISTICS

Plating material	Plating characteristics
Silver	General-purpose plating for power contacts. Shelf life is poor. Will tarnish when exposed to atmosphere, and contact resistance will increase. Problem with low-level circuits.
Gold	Excellent conductor, very stable material. Hard gold platings good for repeated insertions. Has low contact resistance and excellent corrosion resistance.
Nickel	Excellent corrosion resistance, fair conductivity. Generally used as an undercoat where high temperatures would cause migration of silver through gold. Must be properly controlled during plating to insure that plating does not crack during crimping. Good wear resistance.
Rhodium	Used where exceptional wearing characteristics are required. Lower conductivity than gold or silver. On thin films; the increase in resistance can be tolerated. Very high cost.
Tin	Forms cold-welding joint under pressure, good conductivity, excellent solderability, low cost, poor wire resistance.
Gold over silver	Good for dry-circuit applications, low contact resistance, moderate corrosion resistance. Not usually used.
Gold over nickel	Good for repeated insertions and excellent corrosion resistance.
Rhodium over nickel	Maximum wear resistance, high-temperature operation. Has higher contact resistance than other platings.

SOURCE: THE ELECTRONIC CONNECTOR STUDY GROUP INC.

major source of emissions and, therefore, a worthwhile area of exploration. Quite often, the cable assemblies that link the parts of a system emit more radiation than the equipment itself.

The need for shielded cabling has generated much interest in the development of compatible shielded connectors. Military-style shielded connectors are readily available for all types of uses, and their shielding effectiveness is well documented. These connectors are expensive and typically exceed the shielding effectiveness of commercial shielded cable.

Since a system's control of emi and rfi is only as good as its weakest component, over-designed shielded connectors add nothing but cost. Designers of electronic equipment for competitive markets require a low-cost shielded connector that matches the performance characteristics of commercial shielded cable.

Contact Materials

Attempts to replace gold on electrical connector contacts have been made primarily to relieve economic pressures caused by the usually high and always volatile price of this material. At the same time, engineers would like to retain all of the functional advantages of gold as an electrical-contact surface.

One solution is not replacement, but gold preservation programs. For example, gold plating has been limited to the small, functional contact areas only. Thus, selective plating techniques eliminate gold from regions not actually involved in the contact function. And in the regions where gold is still required, the use of the latest plating techniques has resulted in a reduction of plating thickness.

Unfortunately, the attempt to replace gold completely has not been as successful. Although nonnoble metals and alloys, such as tin and tin-lead, have been found useful for some applications, no way has been found to make them perform like gold. Other precious metals—silver and palladium—have been extensively studied, but still fall far short of the gold performance standard.

Gold, palladium, platinum, and indium are relatively resistant to environmental exposure. Silver is resistant to oxidation, but is subject to to sulfide buildup. Copper, nickel, tungsten, molybdenum, and brass are subject to oxidation and other forms of environmental attack.

Pure tin plating on interconnections can spontaneously grow thin metal filaments (commonly called whiskers) crystal, pure metallic outgrowths can grow to sufficient length to short-circuit adjacent low-voltage circuit paths. Also, broken whiskers can result in bridging.

Whisker growth relieves the state of internal deposit stress by induced recrystallization in the form of unidirectional outgrowth, rather than internal grain growth. A most effective means of eliminating tin whisker growth on contacts is the use of a tin-alloy plate.

For low-voltage and low-current applications, gold remains the primary cover metal because it resists corrosion and film formation and maintains low surface contact resistance. Platinum, palladium, and silver offer similar properties. Other substitutes for gold include bright tin-lead and bright acid tin. Table 1 gives a rundown of plating materials and their characteristics.

As a result of extensive research and practical experience in which several hundred million contacts have been in use since 1977, a third alternative comes very close to achieving both objectives. This contact surfacing technique—called Amp-Duragold plating by its developer Amp Inc., Harrisburg, Pa.—consists of a special layered composite coating. It is a thin gold plating, applied over a special palladium electroplate, which in turn, is applied over a nickel barrier underplate. This system retains the ideal gold contact surface, with very cost-effective use of precious metals, the company claims.

Contact Termination

Anyone who has struggled with stripping the insulation from a wire in hooking up a car stereo or changing a lighting fixture can appreciate the desire for quick and sure joining, or terminating, as it is called in the trade. A connector can be joined to its wire or cable by a number of means: soldering, wire wrapping, crimping, metal-to-metal contact resulting from the physical displacement of insulation, and welding. Each technique has benefits and drawbacks, and in choosing a termination system, a user must make trade-offs. Table 2 unfolds the strengths and weaknesses of many of

Designed Into Every Welcon Connector

For over 20 years Wells has been manufacturing interconnection devices. The semiconductor industry recognizes them as the producer of quality burn-in/test sockets used in the testing of IC devices. Their sockets, subjected to extreme temperatures over extended periods of time, withstand thousands of insertion/withdrawal cycles. Innovative designs coupled with a reputation for quality has made Wells the leader in burn-in/test sockets.

This high regard for quality is also evident in Welcon card edge and D-subminiature connectors. You'll find a strengthening rib in the tail of the D-subminiature that serves as a built-in heat sink to prevent solder wicking and assures excellent contact alignment. Plus a 45° chamfer on the face edge for mating ease, a large cavity lead-in and the metal shell version consisting of one-piece construction. Standard features not found on most D-sub connectors.

The card edge connectors on .156″ × .188″ spacing have been specially tailored toward the telecommunications industry. Low contact resistance, easy board insertion and shorting contacts are just a few of the features designed into this connector to give you maximum reliability. The same holds true for the card edge on .100″ × .200″ spacing—guaranteed high performance.

If quality is one of your primary concerns, then Welcon connectors are your right choice. Quality . . . synonymous with Welcon sockets . . . continues in Welcon connectors.

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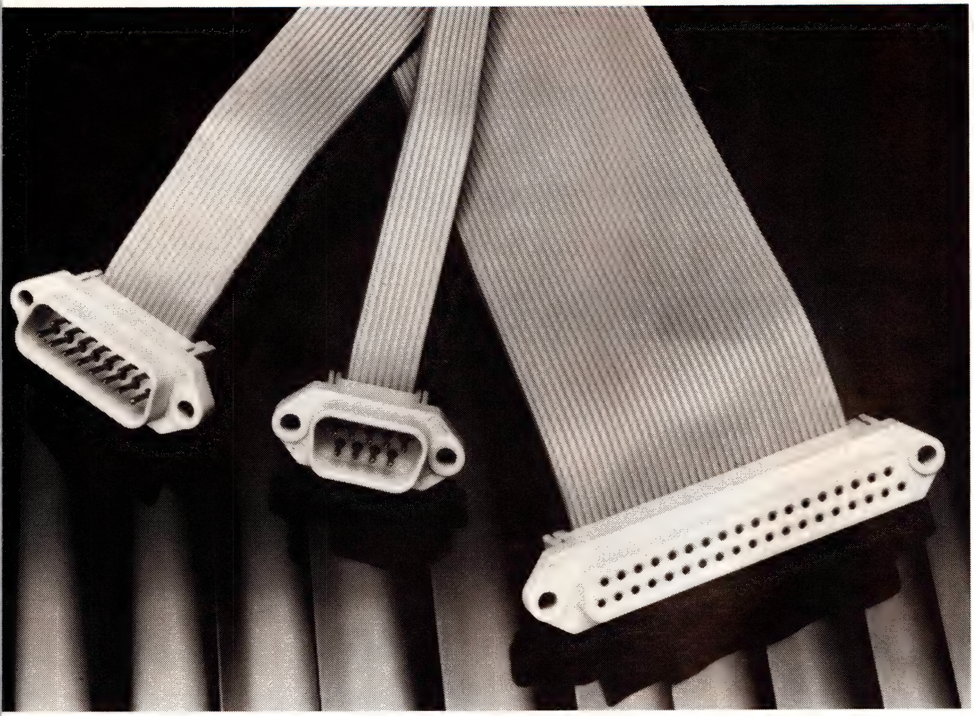
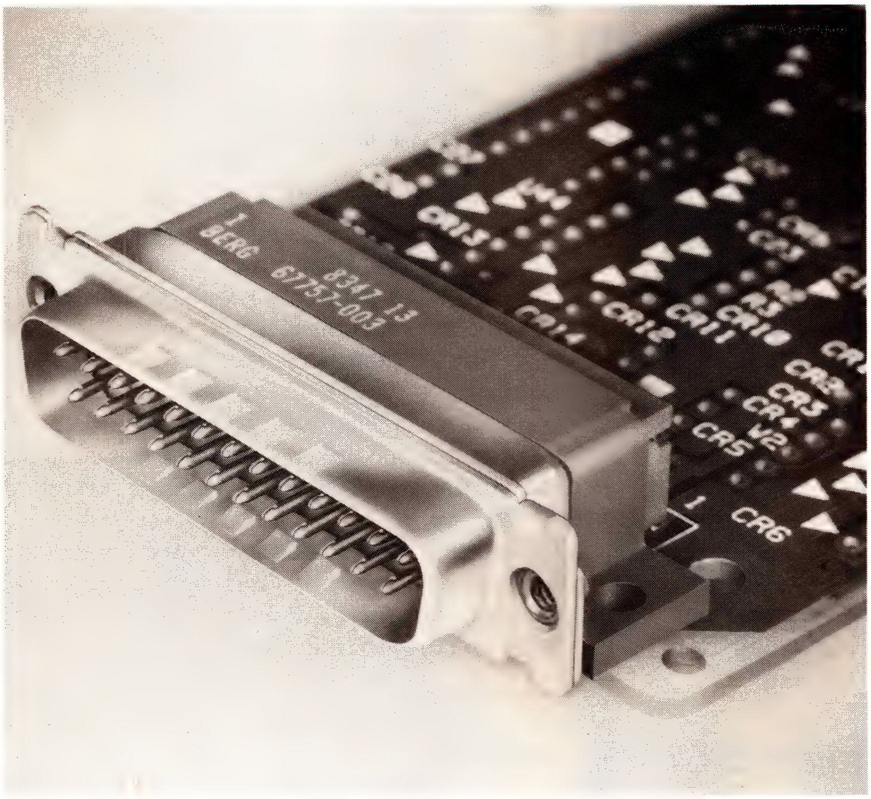


These D subminiature connectors, from Belden Electronic Wire and Cable of Geneva, Ill., are now available with 9, 15, and 37 contacts, in addition to the original 25-position connector. The nine-position connector can be used for applications involving RS-422 interfaces, and the 37-position model for RS-449 and RS-422 interfaces. [Circle 444]



the termination techniques.

For permanent connections, the most common method is soldering, in which a molten alloy melts the metals so they bond together. In choosing soldering, a designer must consider metallic continuity between the solder material and the surfaces that are soldered. In a good joint, solder and base-metal atoms mix to form an intermetallic layer, which is not too thick but attains the desired strength. Both wave soldering and its variants and reflow soldering are the two most popularly used soldering techniques.

Wrapping the Wire

A wire-wrapped connection is formed by tightly wrapping a bare, ductile metallic conductor around a hard, prism-like post. The lack of perfect ductillity in the wire results in an unsymmetrical contact area: the section following the direction of the wrap exceeds that on the leading side of the wrap.

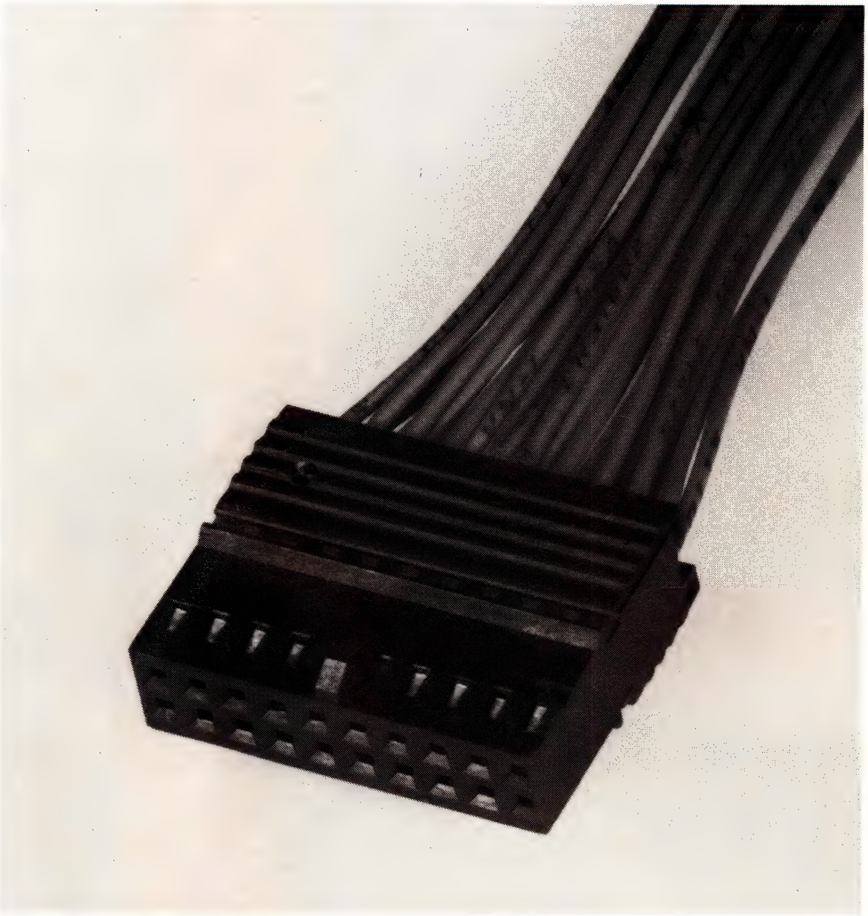
Wrapped connections can be made with portable electrical tools or stationary machines. Insulation is removed from the wire, which is inserted in a slot of the wrapping bit with its insulation butted against the bit face. The wire is positioned over the terminal to be wrapped. The tool is activated and the connection made.

Tools are also available to check the strength of wrapped electrical connections. They grip the wrapped wire and pull the wire off the terminal under controlled force. The amount of force necessary to cause a failure is registered on a dial. This method is used to check the performance of wrapping tools to assure an adequate electrical and mechanical connection.

Another form of a permanent connection, a crimp termination, is made by a metal sleeve secured to a

Available in straight and right-angle header designs, these D subminiature planar filter connectors from Du Pont Co.'s Berg Electronics unit, Camp Hill, Pa., offer a cost-effective solution to limit electromagnetic interference radiation from computer I/O cables. The planar filter is an alternative to costly tubular filters. [Circle 445]

Designed to lower a customer's cost through mass termination, the 8676 connector mates with 0.025-in. pins and all the other dual-row headers from Molex Inc., Lisle, Ill. The connector's dual beam contact is selectively plated tin over copper or gold over nickel in the critical area and tin in the insulation displacement area. [Circle 447]

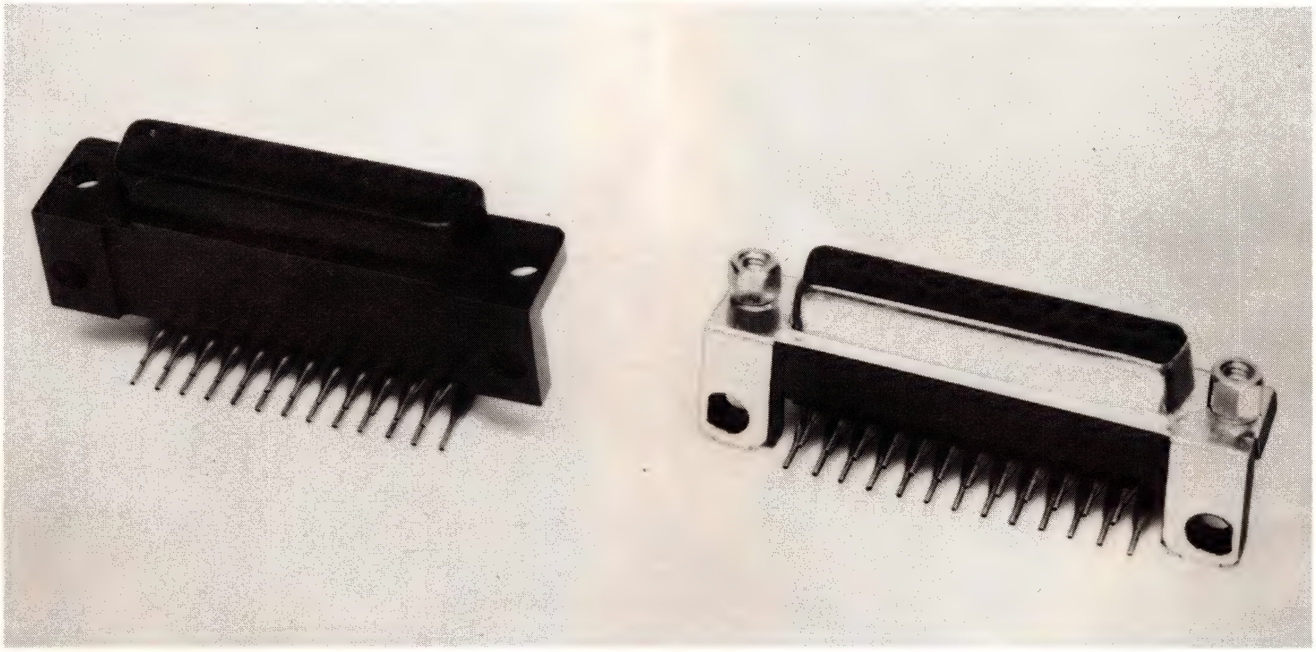


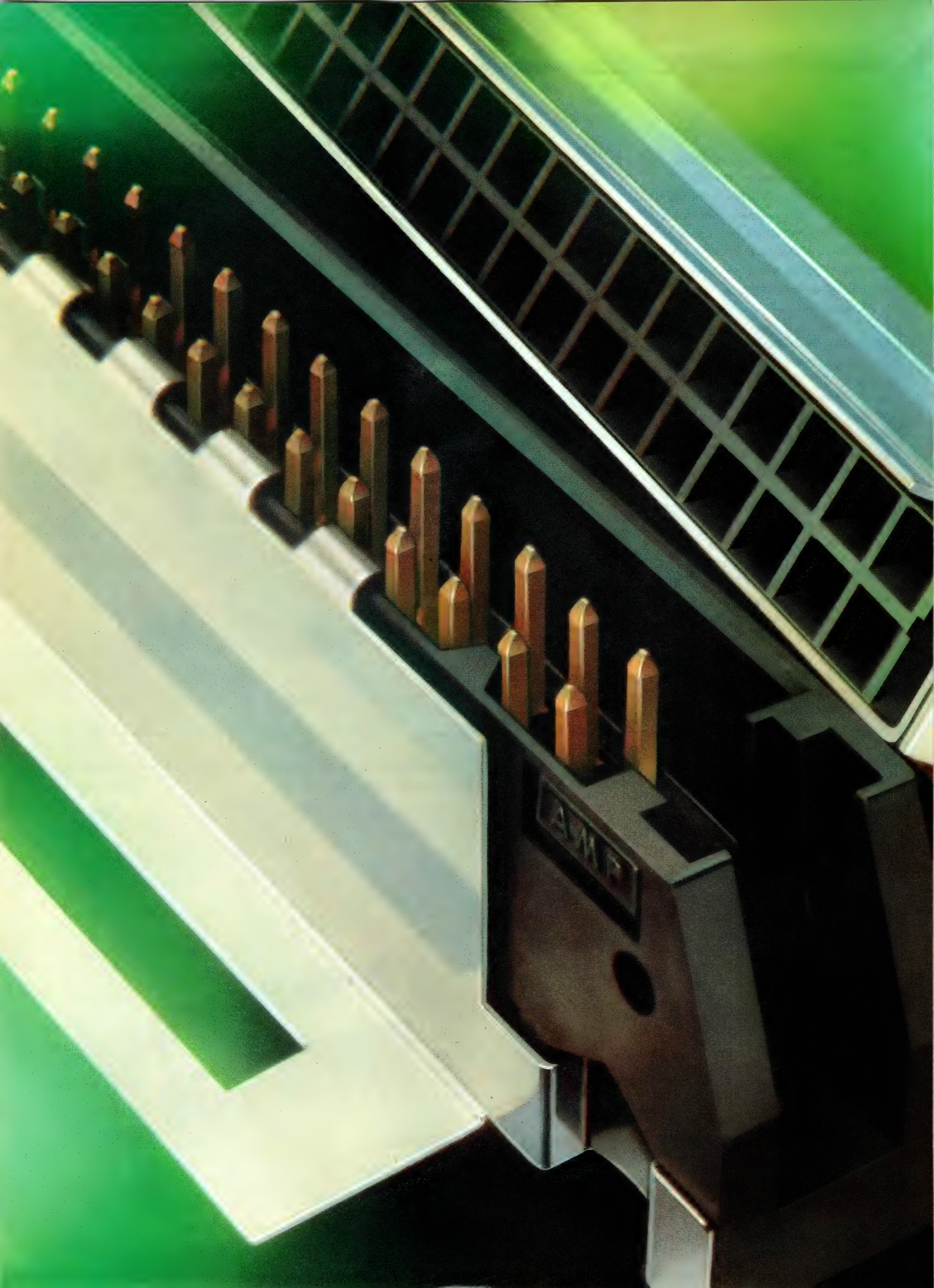
conductor by crimping it with pliers, presses, special tools, or automated crimping machines. Splices (joined wire), terminals (metal tabs), and multicontact connectors are typical terminating devices that are attached by the crimping technique.

Simpler designs of splices and terminals are available in continuous strips for automatic machine operation. Some have barrels or walls with sharp serrations or grooves on the inside. These sharp edges, perpendicular to the axis of the wire, pierce or strip the insulation from the wire when the barrel is crimped. The conductor metal is forced into the serrations to establish intimate contact and a strong uniform joint. Solid or stranded conductors can be connected by this method.

A termination technique similar to

The series 420 and 423 D subminiature connectors from Wells Electronics Inc. of South Bend, Ind., come in two styles: the series 420 are all plastic with a 0.590-in. footprint, while the series 423 are metal versions with a 0.318-in. footprint. [Circle 446]

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And the cable half fits the board half perfectly.

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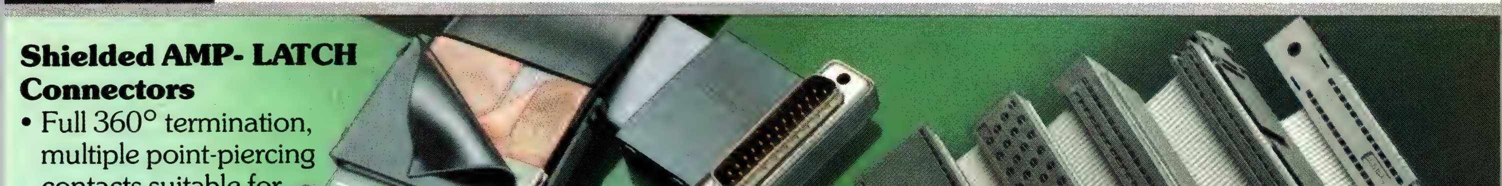

Shielded AMP- LATCH Connectors
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- Snap-on plastic cover provides strain relief.

Subminiature D Connectors
- Mates with existing metal-body subminiature D headers.
- Metal shield fits over standard AMP subminiature D cable connector.

Standard AMP-LATCH Connectors
- Styles, shapes and configurations to fill any need.

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TABLE 2: COMPARING COMMON TERMINATION METHODS

	Crimp (Compression junction)	EPB	Solder	Welding
Ease of operation	√√	√√	√	√
No insulation Removal required	√√[1]	√√		
Contact density	√[2]	√√[3]	√√	√
Production-oriented	√√	√√	√	
Termination Peel strength	√	√		
Shear strength	√	√	√	√
Electrical joint conductivity	√	√√[4]	√√[4]	
Metallurgical bond		√√	√√[5]	
Termination repeatability	√[6]	√√		
Conductor configuration	√	√√	√√	√√
Contact geometry	√	√√[7]	√√[7]	√√[7]
Simultaneous termination	√	√√		
Shared termination Strain relief		√√	√√	

√ = Good
√√ = Better

1. Possible insulation entrapment
2. Usually 0.100-in. minimum center-to-center contact spacing
3. 0.050-in. single-layer center-to-center contact spacing
4. Maximum joint interface
5. Alloy material required for bond
6. Subject to die wear for each line termination
7. Simple straight shank contact

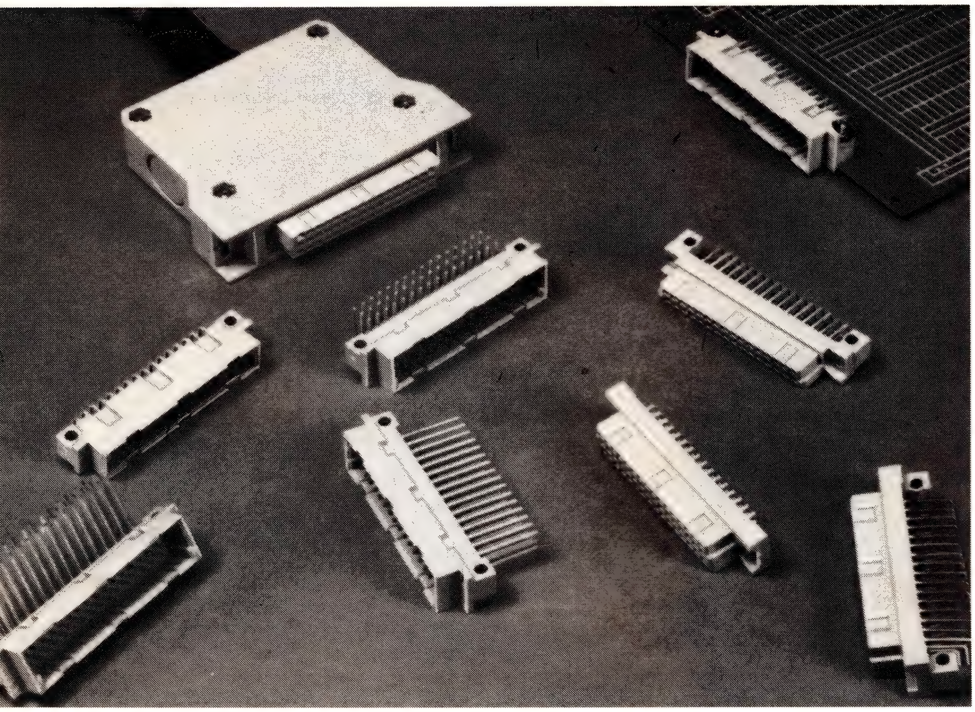
SOURCE: THE ELECTRONIC CONNECTOR STUDY GROUP INC.

crimping, insulation displacement is the latest development in the search for labor savings and lower costs. Most types of these connectors, called IDCs, require no previous removal of the insulation from the cable before assembly, because the contacts pierce and displace the insulation as the assembly tool wedges each conductor home into each contact clevis. Nearly all IDCs consist of two major components: a base to match the ribs of the flat cable that it will grip after assembly and a body that contains the insulation-displacing contacts.

The usual three-step procedure begins with laying the ribs of the correctly trimmed cable into the grooves of the base of the prepositioned fixture. Next, the worker places the body on top of the two guides molded into the base. In the final step, the operator actuates the crimping fixture to force the contacts to pierce and strip the insulation and clamp the conductors. At the same time, the cable insulation is squeezed tight and permanently held between the connector base and body.

A number of vendors have their own versions of the technique. In such versions, the contact looks different, but it performs the same insulation displacement and wire-gripping function.

Welding, which is a continuous application of thermal energy, and energy-pulse bonding (EPB), which uses mechanical and thermal energy in the form of a single unified pulse, both join metals through diffusion bonding. A weld may be made by pushing two mating surfaces together and stretching them to fracture any oxide layers and to allow the metals to flow. Another way is by electrode pressure forcing the mating surfaces together, with heat melting the materials at the



These two half-size euro-connectors, Panduit Corp.'s Hi-Con line, are designed for the smaller boards used in compact electronics packages. As with the standard-size connectors, the Tinley Park, Ill. firm's units feature selective high-density gold plating, low mating force, and consistently low contact resistance. [Circle 448]

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- a TI-59 program tracks satellites in elliptical orbits
- an interface program that links a-d chip with microprocessors

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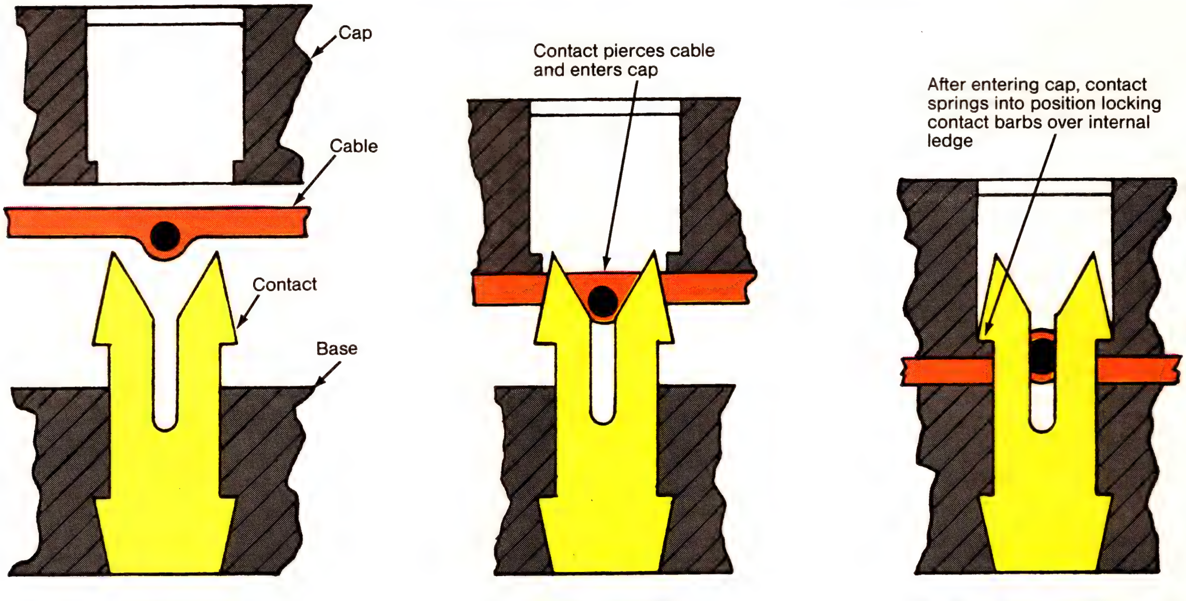
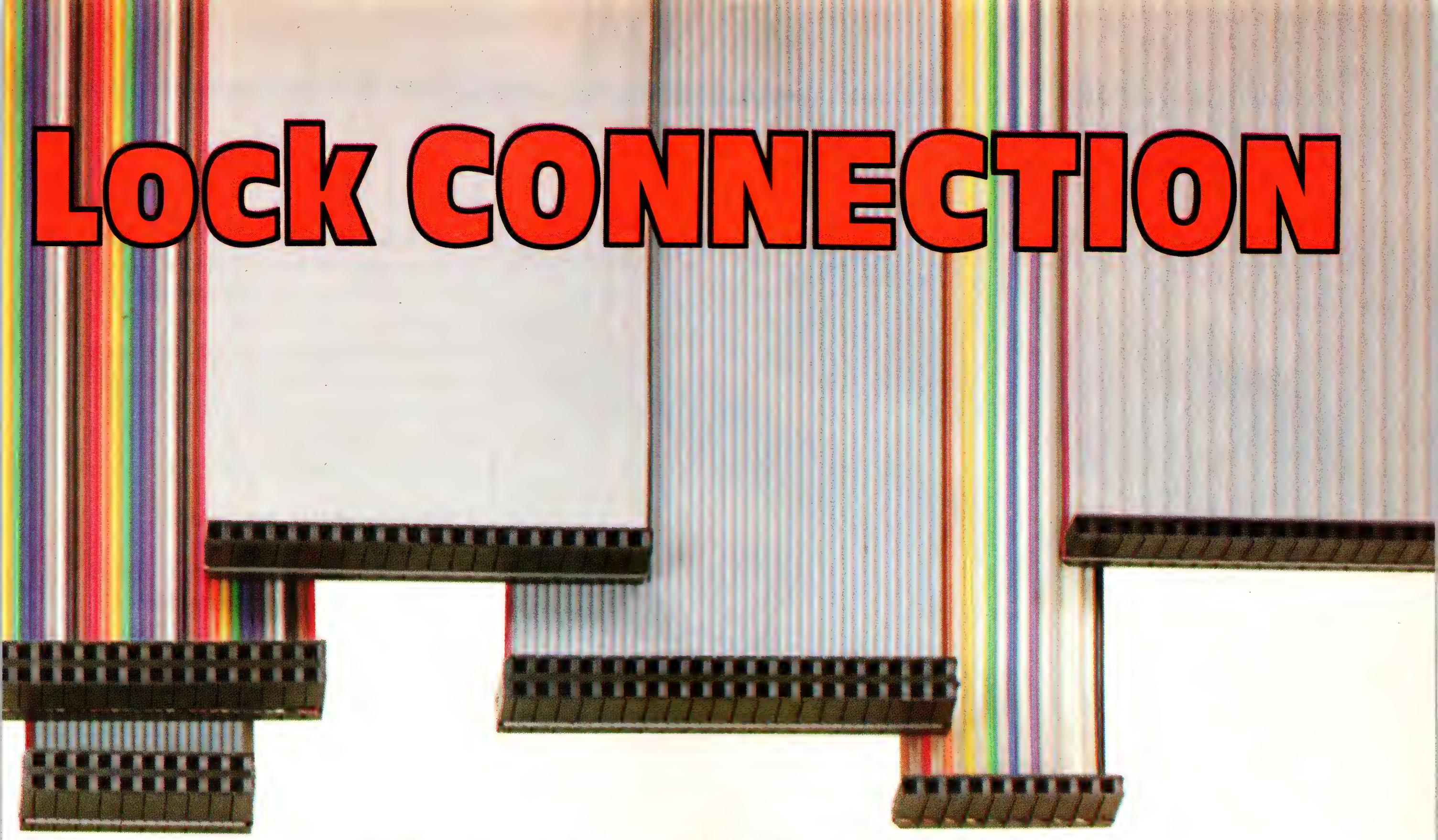

Cap
Cable
Contact
Base
Contact pierces cable and enters cap
After entering cap, contact springs into position locking contact barbs over internal ledge

Positioned **Piercing Insulation** **The Snap-Lock Difference**



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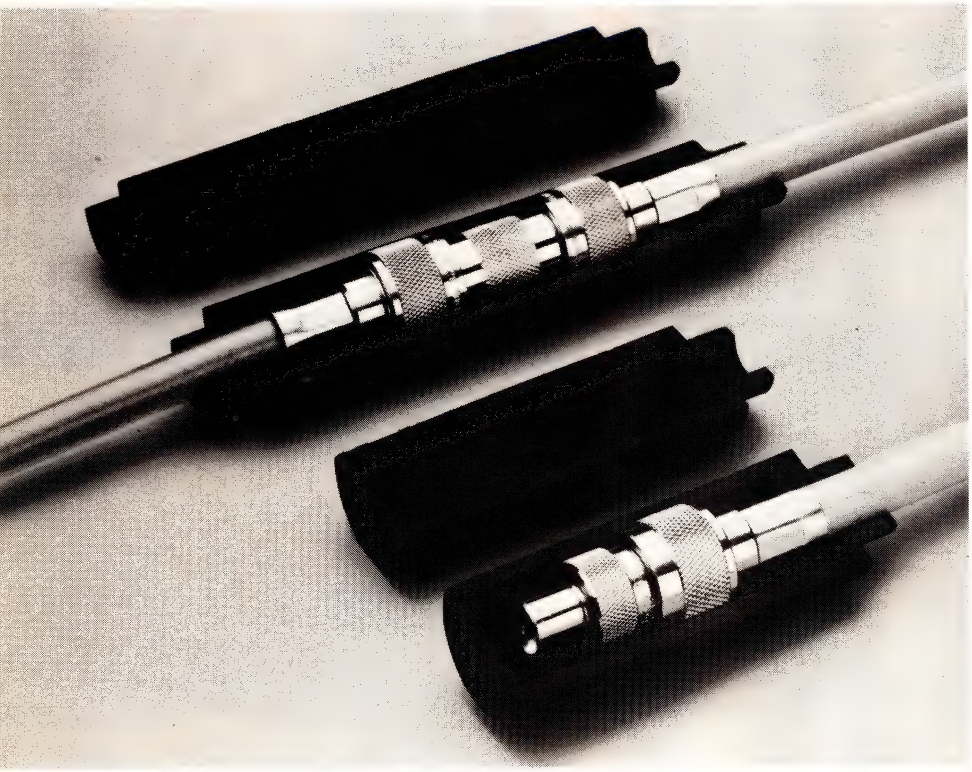
Circle 67 on reader service card



A new series of Type N coaxial connectors from Amphenol Products, Oak Brook, Ill. provide interconnection and termination for most of the popular local networks. The connectors feature crimp-crimp cable and center contact affixing to save money and make installing them easier. Contacts are silver- or gold-plated. [Circle 449]

interface or making the surfaces plastic-like.

Intimate contact between the joining surfaces is necessary for the success of EPB. To assure this contact, the bonding heads deform surface microasperities and disrupt and disperse the surface oxide, thus increasing the actual total area between joining surfaces.

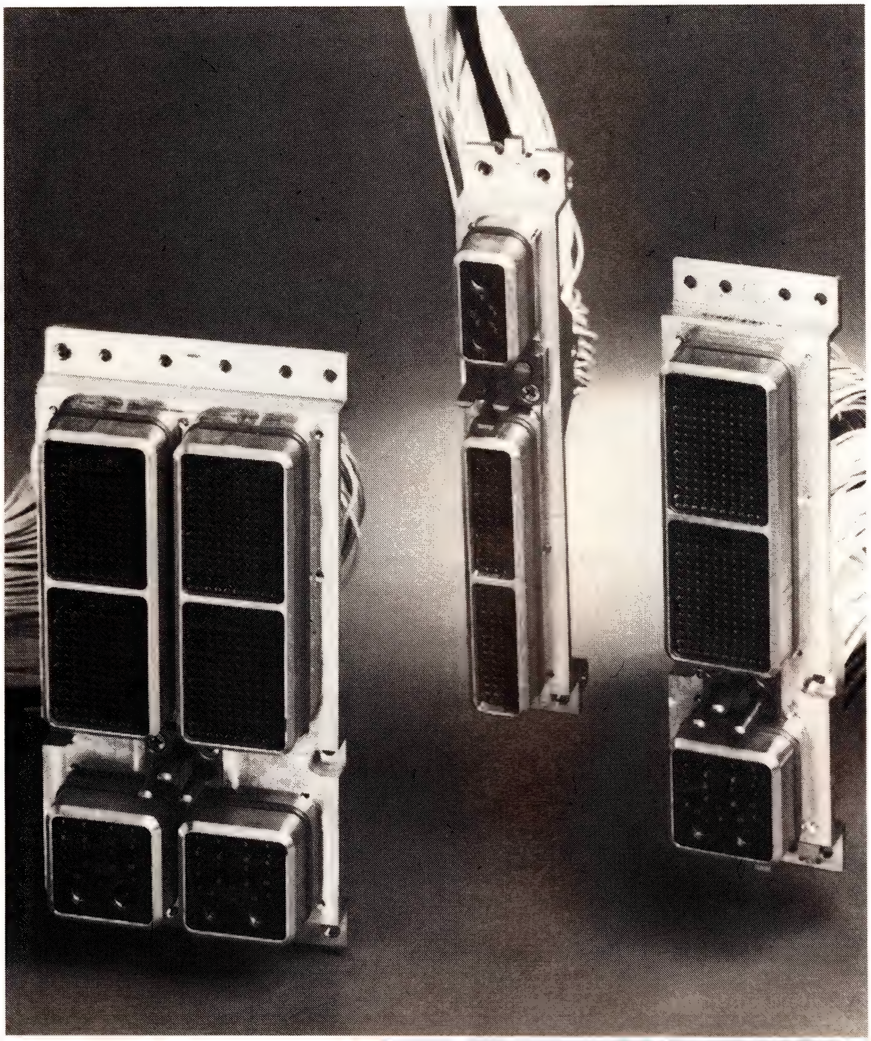
Multiple Disadvantages

EPB offers flat-cable users a cost-effective method of producing large quantities of quality terminations. Cost effectiveness is possible because the process provides:

- Simultaneous termination of multiple joints.
- Elimination of a separate insulation-stripping operation.
- Rapid cycle times.
- High-density terminations
- Terminations of various conductor geometries.

Many of the present termination methods are geared for either round or rectangular conductors but not both. EPB will terminate both types. At the present time, termination contact densities of 0.050-in. centers are common with EPB, and new fixturing may well allow termination down to 0.0250-in. centers.

Although EPB offers many outstanding features, it does have minor drawbacks. Conductor deformation occurs during bonding,



The Arinc 600 rack and panel connector series from Amp Inc., Harrisburg, Pa., has a mating force reduced from typically more than 8 oz. per contact to as little as 1.5 oz. per contact. This reduces stress on avionics and test equipment when high pin count connectors are mated. The connectors have a 500-cycle life, minimum. [Circle 450]

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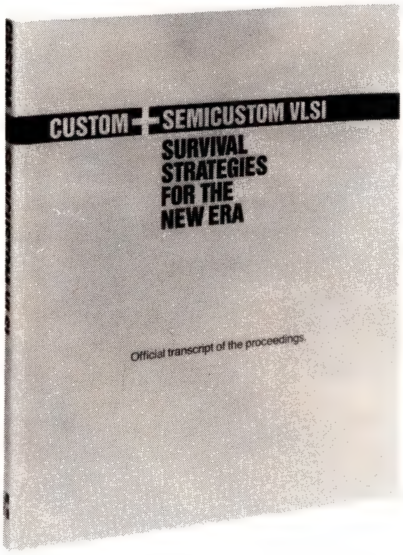
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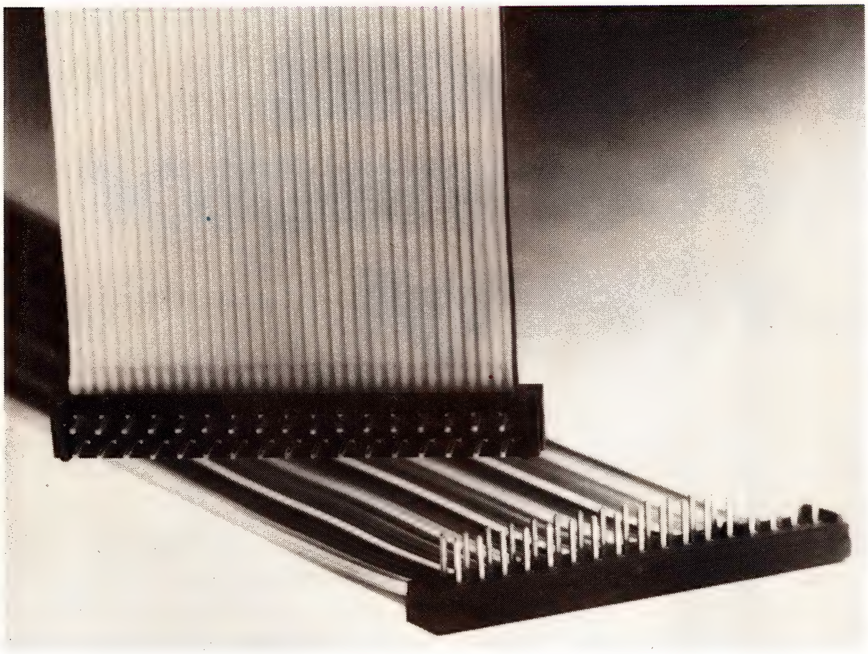
Circle 71 on reader service card



This dual-row board connector can save as much as 70% over the usual header and socket combination. From Symbex Corp., of Chico, Calif., the dual-row board connector solders into a 0.10-by-0.10-in. standard header-hole board layout. Solder standoffs are incorporated on the connector. [Circle 451]

and allowances must be made for this. It may not be possible to form a bond between metals like aluminum and beryllium copper—and, of course, different metals have different resistances. However, in special cases, intermediate platings have been used to overcome this problem. Also, some insulations that contain flame-extinguishing fillers may leave degrading residue in the joint area.

Finally, the time comes when a decision must be made as to what connector system, what type of contacts and their plating, and what type of termination system will be used. At this point, the tradeoffs involved become crucial considerations. The designer can choose from at least 10 different insulator materials, a half dozen contact metals, an even larger variety of contact-plating metals, and from a host of connector sizes, shapes, and styles. Added to this is the need to evaluate the various ways of attaching the connector to wire or cable.

Some connector manufacturers supply requirements review sheets that ask the user to list all of the essential requirements—an example is shown on page 80. If none is available, keep in mind all of the major characteristics and be prepared to quote them to a potential supplier.

Of course, a major consideration that needs little mention is cost. The expression "you get what you pay for" is certainly true in specifying connectors.

The Total Cost Picture

A properly applied connector saves money when considering the total cost picture. It is a factor not only in the total production cost but also in the cost of repair once the product is in the field and needs servicing. The proper connector can save more in labor cost than the additional material cost. It also lowers total installed cost and increases producitvity.

The primary specifying consideration is functional; simply, what is being connected to what and where will the connector be used. List the items to be connected, the type of conductors that will require termination, the number of pins required, and a brief description of what the equipment in which the connector is placed must do.

For example, with pc-board edge connectors, board tolerances are important. For low-voltage circuits, plating and base metals are considerations. Resistance to oxidation is important in the choice of a metal, because the low voltage cannot bust through an oxide coating.

Electrical Requirements

List voltage and current requirements—like maximum voltage and current and voltage transients—and state whether the connector will be used in a low-voltage circuit or power supply, emphasizing that low current and voltage situations require a plating that will not oxidize. A few of the major electrical considerations and their implications are:

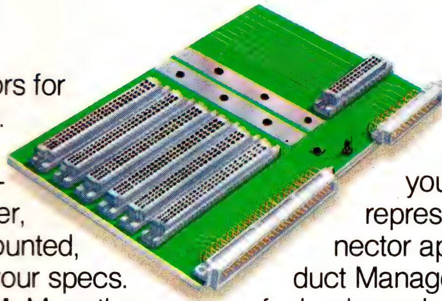
- A millivolt drop for a certain current level. Another way of expressing resistance, the millivolt drop will determine maximum current limitation through the heating effect.
- Maximum current, influenced by the connector and the size of the wires connected to it.
- Maximum voltage, which depends upon the spacing between circuits and the insulating material used (voltage transients also influence insulator requirements).
- Interconnection capacitance, which is very important when high frequencies are involved.

Other electrical parameters include surge current, characteristic impedance, voltage-standing-wave ratio, insertion loss, and emi leakage attenuation.

Probably the major consideration is resistance. When the surfaces of two current-carrying conductors meet, electrons must converge to pass through the contacting asperities, those peaks and valleys that are found on even the smoothest metals. This convergence causes the length of the electrical path to increase, which boosts the effective resistance at the contact interface. This effect is called constriction resistance and contributes to total contact resistance.

Additional resistance can result from oxide films, oils, and similar surface

Elco sets international standards in high-density connectors.



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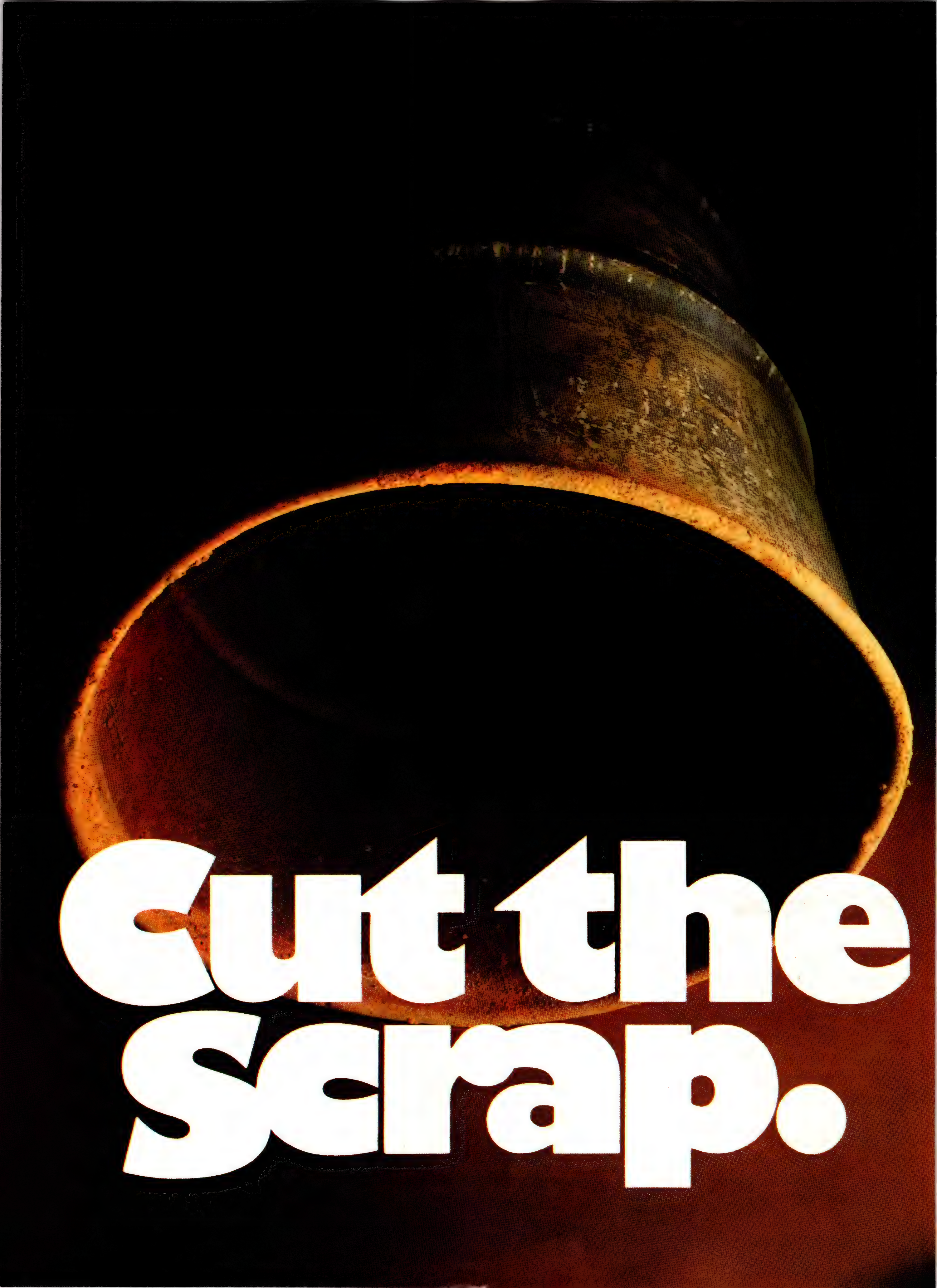

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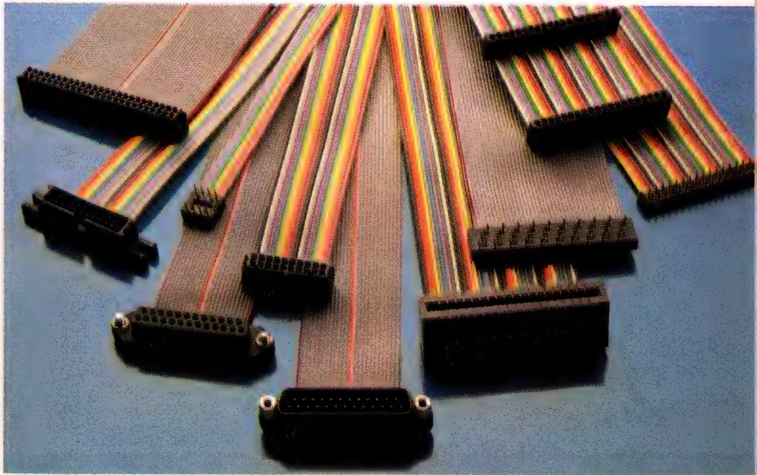

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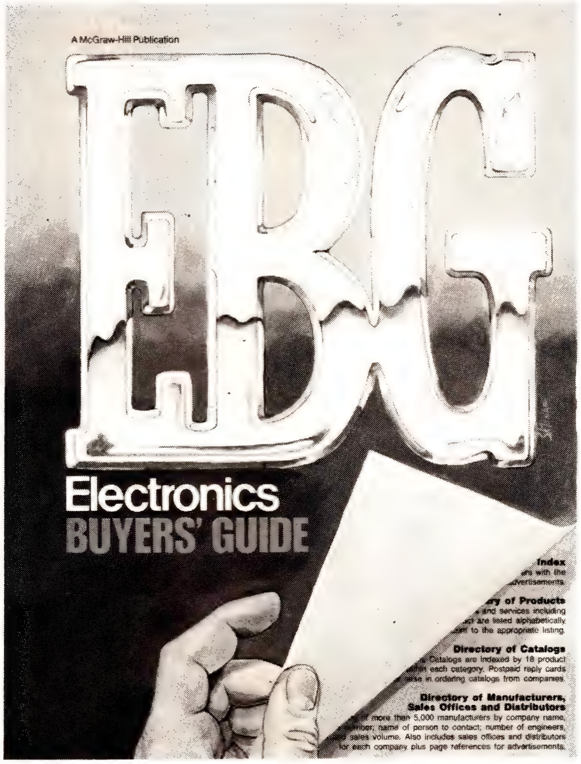
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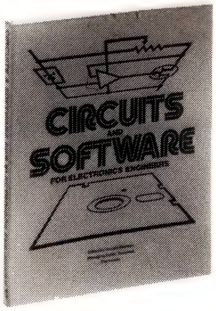

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contaminants that prevent pure metal-to-metal contact. Such films between the contacting metal often contribute the highest portion of resistance to the connector.

The minimum obtainable combined resistance depends upon surface finish, contact pressure, and the kind of metal employed in the connector. An example of the tradeoffs that must be made is particularly clear in the case of resistance.

Aluminum, for example, would be an excellent contact material, if it were not for its tenacious and rapid-forming oxide. Tin is soft enough to allow film-wiping but it has high resistivity. Conversely, copper has low resistivity but is hard. As a result, low-resistance copper contacts often are plated with tin. Other combinations such as gold on copper are used when the added cost is justified.

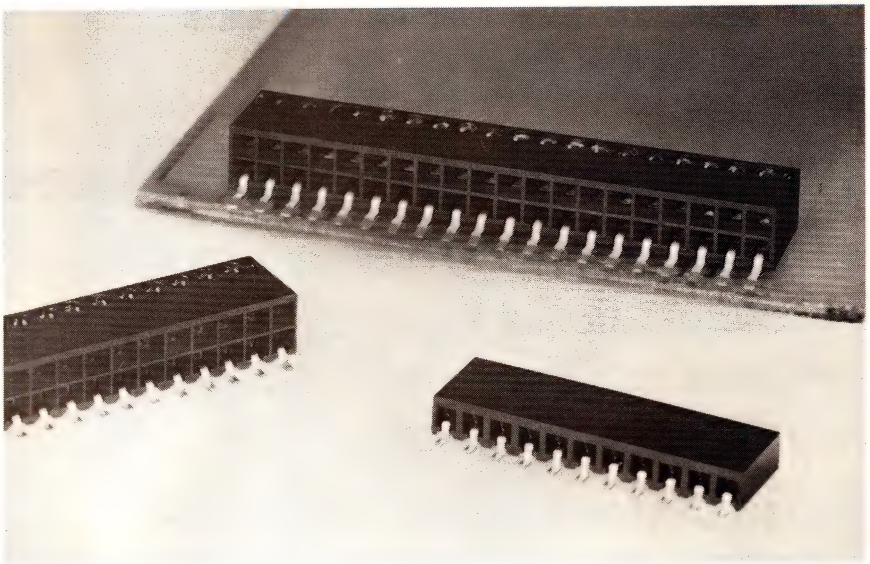
Mechanical Requirements

From the description of the mechanical requirements, the manufacturer begins forming an idea of size, shape, and material requirements. Both the space available for the connector and the dimensional tolerances are important. The former gives a manufacturer an idea of the limitations within which he must work. The latter is important because a manufacturer's tolerances might exceed those allowable by the design.

Restrictions on contact spacing established by the design limits are important to mention. Ruggedness is influenced by contact spacing. Close contacts mean less insulation between them, lower force tolerances, and greater susceptibility to high-voltage problems.

Contact pressure must be specified because high contact pressure requires high insertion and withdrawal force. Frequency of mating will affect the type of terminal, determining whether the terminal could be stamped or machined.

Finally, maintenance requirements are important because maintenance schedules might not agree with manufacturer estimates of the number of times a connector can be connected and disconnected before failing.



With these horizontal card connectors, original-equipment manufacturers can eliminate through-holes in multilayer pc boards and thereby cut the size of the boards. Berg Electronics, Camp Hill, Pa. supplies single-row connectors from 1-by-3 to 1-by-52 positions, doubles from 2-by-3 to 2-by-65 positions. [Circle 452]

The location and anticipated environment of the connector are important. Even the environment a connector must endure during shipping can have an influence on its performance. The location of the connector on a piece of equipment is often an environmental concern because some locations tend to collect moisture and contaminants. In this case sealing may be required.

Time Counts, Too

The estimated time for terminating should be included in any discussion with a potential manufacturer because cost, available terminating equipment, and time alloted for terminating may be incompatible. Connector manufacturers can determine this and suggest alternatives. They can determine if crimp or wire wrapping would offer an installation advantage. Also, a goodly portion of the cost of terminating is associated with the labor involved and the skills of the current work force could influence the decision to obtain new terminating equipment.

One of the most volatile areas of discussion between supplier and purchaser is standards. Different standards may be incompatible, and so tradeoffs may be needed. Also, a connector that meets all of the military requirements and will last an eternity is not necessarily a good idea for use in a consumer product that is designed to last only a few years.

Testing

Only qualification testing makes a connector a proven piece of hardware. It will give a fair indication of performance under most expected conditions.

Ideally, the various tests required for qualification—humidity and water exposure, thermal exposure, vibration and shock, altitude, corrosive environments, fluid immersion, altitude immersion, and rfi shielding—should be performed at the user's installation. Practically speaking, this cannot be done because of the prohibitive cost, and in most cases it may not be absolutely necessary because manufacturer predictions, based on simulated use, will suffice. Nevertheless, the wise specifier of connectors will ask manufacturers if any test results are available. ☐

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CONNECTOR REQUIREMENTS REVIEW SHEET

Name ______________________ Company ______________________

Level of information of requested ______________________

This information is for immediate purchase ______________________ Future purchase ______________________ Reference ______________________

Delivery time required ______________________ Price/connector ______________________ Total applied cost ______________________

What will be connected ______________________

Type of conductors ______________________

Number of connector pins required ______________________

For printed-circuit-board connectors, please list ______________________

Board tolerances ______________________

Plating and base materials ______________________

Resistance (millivolt drop) ______________________ Maximum current ______________________

Maximum voltage ______________________ Voltage transients ______________________

Surge current ______________________ Intercontact capacitance ______________________

Maximum frequency ______________________ Dielectric withstand voltage ______________________

Characteristic impedance ______________________ VSWR ______________________

Insertion loss ______________________ EMI leakage attenuation ______________________

Other electrical requirements ______________________

Space available ______________________ Dimensional tolerances ______________________

Design restrictions on contact spacing ______________________ Connector will be mounted ______________________ Frequency of mating/unmating ______________________

Mating/unmating forces ______________________ Normal force ______________________

Retention force ______________________ Polarization marking or color coding ______________________

Weight limitations ______________________ Anticipated product lifetime ______________________

Required shielding or housing ______________________ Strain relief ______________________

Anticipated maintenance/repair frequency ______________________

Location and anticipated environment ______________________

Ambient temperature ______________________ Corrosive atmosphere ______________________

Altitude ______________________ Humidity ______________________ Salt spray ______________________ Splash presence ______________________

Shipping environment ______________________

Sealing required ______________________

Shaft life ______________________ Storage environment and conditions ______________________

Shock ______________________ Vibration ______________________

Soldering temperature ______________________ Duration of soldering cycle ______________________

Other production factors ______________________

Maximum temperature rise with current ______________________

List and describe the reliability tests that will be conducted on this connector ______________________

How do you plan to terminate this connector? ______________________

What terminating equipment is available (kind and brand)? ______________________

Estimated time for terminating ______________________

Skills of current personnel ______________________

Repair and retrofitting plans ______________________

Standards connector must meet ______________________

Special platings, etc., required for cosmetic reasons ______________________

Color and style requirement and preferences ______________________

Contact metals and/or insulation materials preferred (please list) ______________________

______________________ that you will not consider (please list) ______________________

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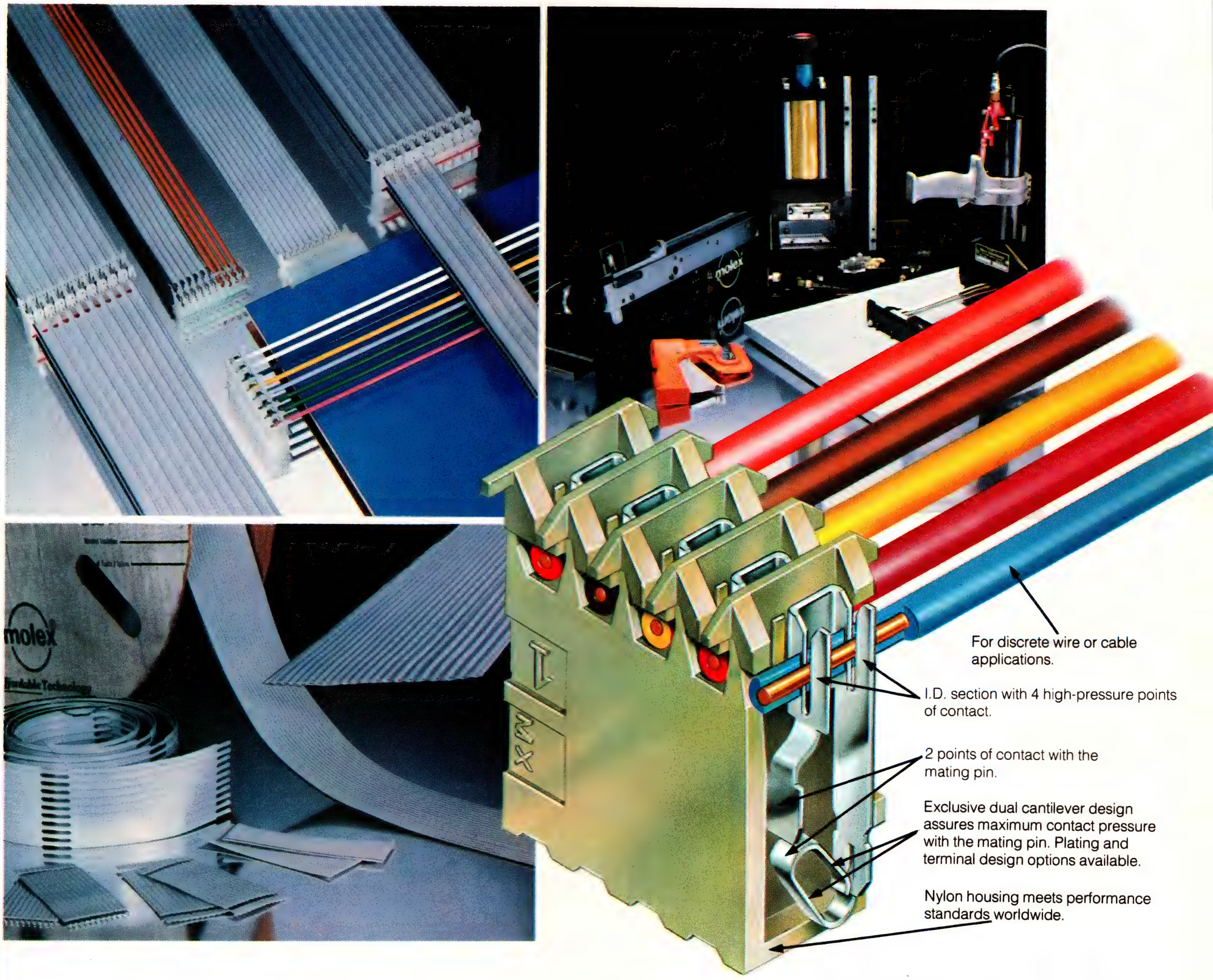

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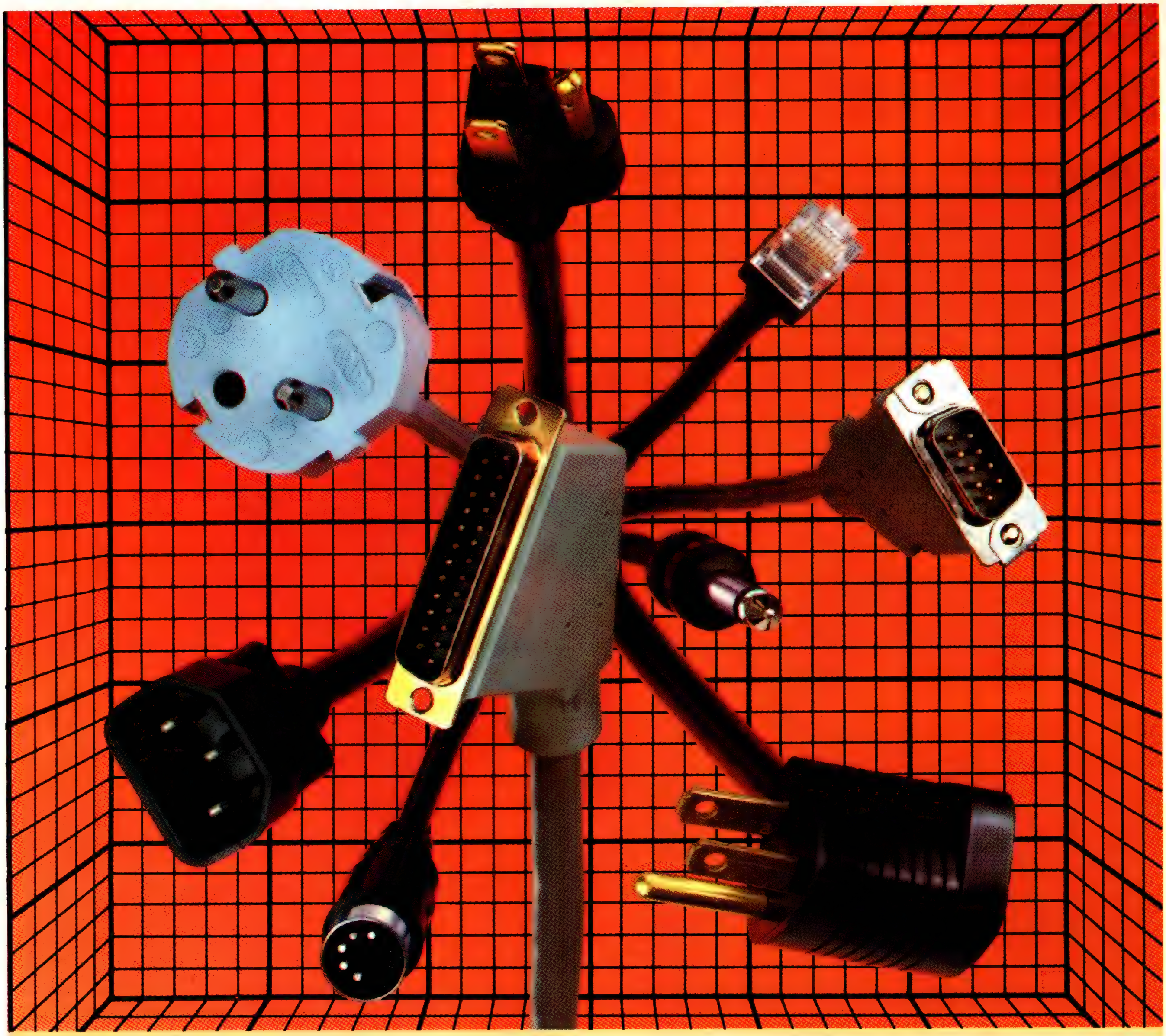

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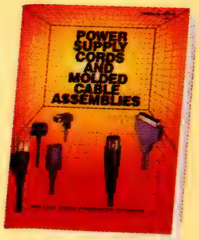

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AI PIONEER TALKS UP VOICE-ACTIVATED TYPEWRITER

Waltham, Mass.

Commercial development of artificial intelligence is leading firms in different directions in search of easier man-machine interfaces. Not the least of these is the commercial voice-activated typewriter. While no one has yet developed any such product, its market potential is significant, with industry projections varying between $1 billion and $5 billion within five years.

One long-time participant in the struggle for improved man-machine interfaces is Raymond Kurzweil. The founder and president of Kurzweil Applied Intelligence Inc. (formerly Kurzweil Speech Systems Inc.), he is bullish on his firm's ability to deliver such a product.

So far, sales of Kurzweil products—an Optical Character Recognition machine and a keyboard-type music synthesizer—are providing revenues of close to $20 million annually—with a growth rate of between 20% and 40% per year.

AI mavericks. Founder Raymond Kurzweil (right) and chief executive officer Michael Tomasic, originally from Digital Equipment Corp., nod heads at Kurzweil Applied Intelligence in Waltham, Mass.

Kurzweil is predicting a 1986 introduction for his firm's major product, the voice-activated typewriter. Also, he plans to introduce a database system that can be accessed by voice, which will make the interface between man and computer increasingly natural.

Broad AI orientation. Kurzweil's corporate objective is the development of a flexible, large-vocabulary speech-recognition capability. "This is a goal that encompasses the VAT, but it will eventually be expanded to include a voice-accessible data base," he says. "We want our new name to reflect this broader artificial-intelligence orientation."

So far, his record has been the envy of the AI community. Janet Baker, president of Dragon Systems Inc., another Boston-area firm involved in speech recognition, is quick to give Kurzweil credit for translating AI concepts into products. The reading machine can scan virtually any printed material and read it aloud through a voice synthesizer in an acceptable intonation. The music synthesizer is said to be so good that even a practiced ear can't tell it from the instrument it mimics. But compared to the demands of speech recognition, their development was easy.

Spoken English presents profound difficulties because, it has been estimated, 10 billion computations are necessary for the recognition of a 10,000-word vocabulary; the number of patterns the voice-activated typewriter must recognize is enormous.

To address the problem, Kurzweil has taken an approach different from other firms reported to be working on speech recognition, such as IBM, AT&T Bell Laboratories, and NEC. Kurzweil and his associates are focusing less on computational hardware and more on linguistic algorithms.

To the extent that Kurzweil Applied Intelligence is relying on hardware, it has customized a Motorola Inc. 32-bit chip operating under AT&T Bell Laboratories' Unix software and programmed in C to handle the acoustic aspect of recognizing speech. The firm has designed an array processor to deal with the linguistic permutations that arise from natural language. Rather than simply matching the spoken language with stored waveforms, Kurzweil's voice-activated typewriter uses natural language algorithms to actually interpret what was said.

In its efforts to limit the potentially astronomical number of simultaneous calculations involved in recognizing a spoken word from a 10,000-word vocabulary, Kurzweil is developing AI software whereby the identity of a word may be predicted from its context in a sentence. For example, if the machine hears a verb, it might expect a preposition to follow. If the preposition happens to be "for," the voice-activated typewriter will know to print "for" rather than "four." In this way, the machine's raw computational requirements are dramatically reduced because it can narrow the choices of what it has to listen for.

All this work soaks up great quantities of money, and the firm recently completed a private stock offering that raised its assets to $6.25 million. Leading participants were Xerox, Wang Laboratories, and Kidder, Peabody & Co. Xerox also paid an undisclosed amount for a nonexclusive marketing agreement for Kurzweil's speech-recognition products.

With about 60 employees, Applied Intelligence and its backers are expecting a big payoff from Kurzweil's work. Ted Withington, a market researcher at Arthur D. Little Inc., Cambridge, Mass., sees a $1 billion-plus market by 1989, with relatively cheap machines for recognizing noncontinuous speech. But he is somewhat less optimistic than Kurzweil about a voice-activated typewriter that can perform secretarial tasks. "To my knowledge, the technology just isn't there," he says.

Kurzweil, however, cites estimates of a $5 billion market by 1989 and expects his voice-activated typewriter to supply a substantial percentage of that market by transcribing natural human speech. **–David M. Weber**

U.S. semiconductor start-up plants roots in Scotland

London

It sounds like a typical beginning for a high-tech start-up. An aggressive 40-year-old executive identifies an opportunity that his own company decides not to pursue. He gathers designers, production engineers, and marketing men, compiles a business plan, and starts canvassing for venture capital.

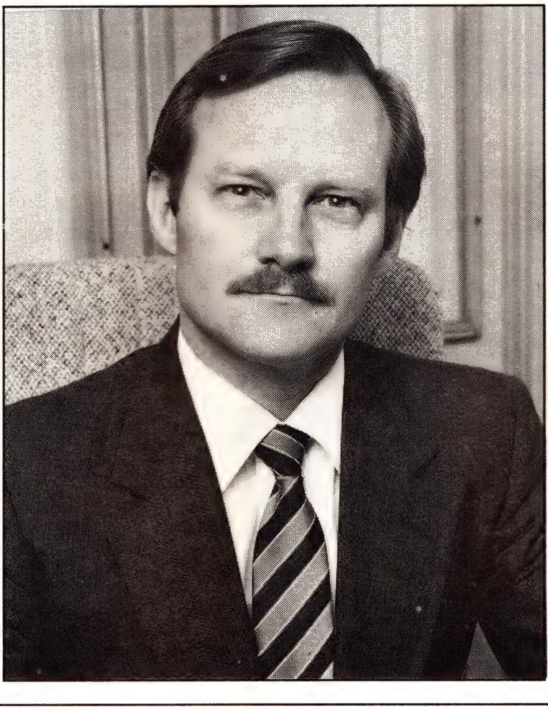
Then the script takes an unexpected turn. Rather than tapping local funds, he turns to UK backers. Instead of moving to Silicon Valley, he sets up shop in Livingston, Scotland, tagged Silicon Glen by the Scottish Development Authority.

The executive is David Wood, former director of engineering for Silicon General Inc., a Concord, Calif., maker of linear circuits. His firm, Integrated Power Semiconductors Ltd., plans to manufacture smart power devices.

Wood has been in the power semiconductor business for 20 years, 12 of them with TRW Inc., Cleveland, and its RF Semiconductors Division. He has served as a plant manager and in sales and marketing in the U.S. and overseas. In 1967 he joined Silicon General and by 1979 was its international head.

During this period, he was asked to plan a European manufacturing operation, which the firm rejected. So the idea of executing it himself started to crystalize. In his plan, IPS would develop power-control integrated-circuit products, including motor and hammer drivers, power-supply control circuits, and voltage regulators to drive motors in printers, typewriters, and disk drives.

The plant would be set up in Europe, where indigenous competition is weaker than in other markets, explains Wood. Also, the plant would be inside the 17% European-component tariff wall. Scotland—especially the 50-mile-long belt between Glasgow and Edinburgh—was the obvious site. With firms such as Motorola, National Semiconductor, and NEC making chips in the area, it has an established infrastructure.



A bonny venture. For strategic and financial reasons, U.S. entrepreneur David Wood turned to Scotland to locate his semiconductor start-up.

Wood toured London financial houses before lighting on Investors in Industry Group plc (3i), which has invested in such U.S. semiconductor firms as Linear Technology, LSI Logic, and Micro Linear. At 3i, Bernard Fairman and Peter English worked with Wood's proposal for a year. It originally called for an initial capitalization of $12.4 million, with break-even projected in five years.

The "sheer size of the start-up was unusual for us and for anbody else in the UK," says Fairman. "We wanted to see a smaller initial outlay, an earlier cash flow, and break-even in year three." The three cooked up a scheme whereby IPS would second-source a few products and subcontract their production to foundries in the U.S. By April 1984, Fairman and English put together a consortium prepared to put up $5.58 million. IPS also qualifies for $5.2 million in government grants.

Atlantic crossings. One barrier remained. Although Wood had set up a design and process team for IPS's first products in California, his strategy hinged on transplanting them in Livingston. "All last summer, I flew families over here, to see [the facilities] for themselves," says Wood. Because engineers were impressed and their spouses liked the lifestyle, construction of a plant is pressing ahead at Livingston; it is scheduled to be onstream before 1986.

IPS could be shipping second-source chips by the end of 1985, while the first ICs of its own design will be out by early 1985, according to Jürgen Ockens, worldwide sales and marketing director.

The next milestones are looming already. A second round of funding will be needed by the end of next year, but it will be conditional on bookings of $1 million, the establishment of U.S. and European sales forces, and progress on the Livingston plant. **–Kevin Smith**

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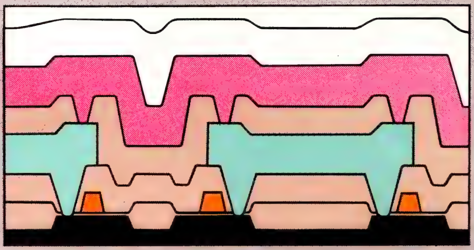

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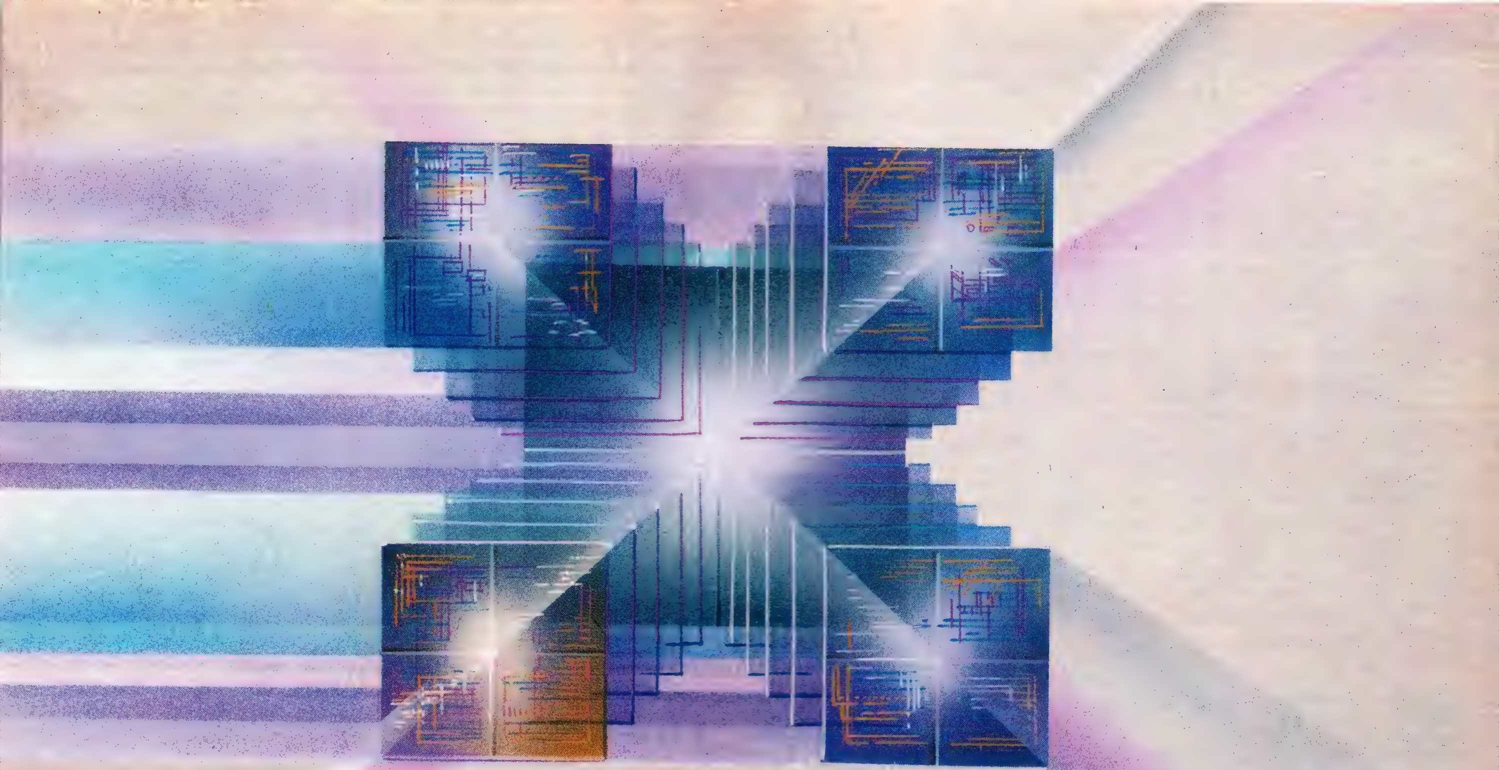
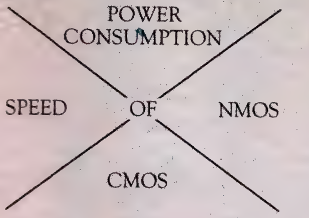
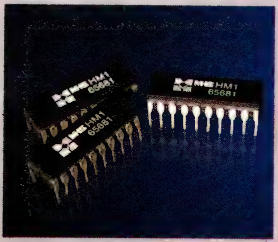


4K x 4 : a new memory concept



MHS introduces the first 16 K static memory with dynamic activation HM 65681.

The design approach is in itself an achievement, bringing together the advantages, hither to irreconcilable, of the speed of NMOS and the power consumption of CMOS in a single circuit. The new memory by MHS now makes available the performance benefits of these combined technologies.



Organized as 4096 words of a 4 bits, the design is completely new and it is the first all-pulse 16K memory on the market.

Principle of operation:
A sense detection stage changes in level at the pins (commands and addresses) and transmits a pulse element to a controller which generates different signals of optimum width to ensure dynamic validation of the internal functions of the memory.

Result: The best compromise between speed and power consumption available on the market.

With a 10 MA/ICCOP specification, the 4K x 4 far outclasses the competition for speed versus power consumption, over the whole range of temperatures from — 55 to 125 degree C. MHS also guarantee 55 MW consumption at 70 degree C., which gives an average well below standard products, proportional to the frequency of use.

Finally, this new memory, like all the other members of the MHS 16K family, has a select chip controlled input structure, which gives it a low quiescent power consumption at intermediate voltage levels (VIH).

4K x 4 format: greater design flexibility + higher speeds.

The original configuration of this new memory gives designers two important advantages:
– great flexibility in application through the reduction in package size – only 20 pins compared with 24 for the 2K x 8 half the size but the same memory capacity.
– high speed in operation because the capacity of the input/output buses, which is normally a performance – limiting factor, is compensated by optimised output buffers. The number of buffers and bits being the same, performance goes up and size goes down.

The technical features make this memory particularly suitable for military (radar/sonar, guidance systems, aiming systems) and DP (file memory) applications.

Performance chart of the HM 65681 memory.

HM 65681	0°C to 70°C	− 55°C to 125°C
Access time	55*/70/85	70*/85/100
Operating supply current Iccop at 1 MHz	10 mA	15 mA
Standby current		
• Iccsbl at $\overline{CS}$ = Vcc–0.3 V	50 µA	900 µA
• Iccsb at $\overline{CS}$ = VIH	3 mA	4 mA
Package	20 pin plastic, ceramic, LCC	

*Introduction Q1/85

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SPECIAL REPORTS

RENDERING ADDS REALISM TO GRAPHICS

By using wire-frame, depth-buffer, and ray-trace methods, it is possible to create 3-d images ☐ *by Richard Fichera*

According to recent studies, a picture is worth a lot more than a thousand words. Although people can read 400 to 1,200 words per minute, some types of data, when presented graphically, can be assimilated at rates that are up to 100 times faster. With one picture worth more like a million words, computer graphics is one way to increase productivity.

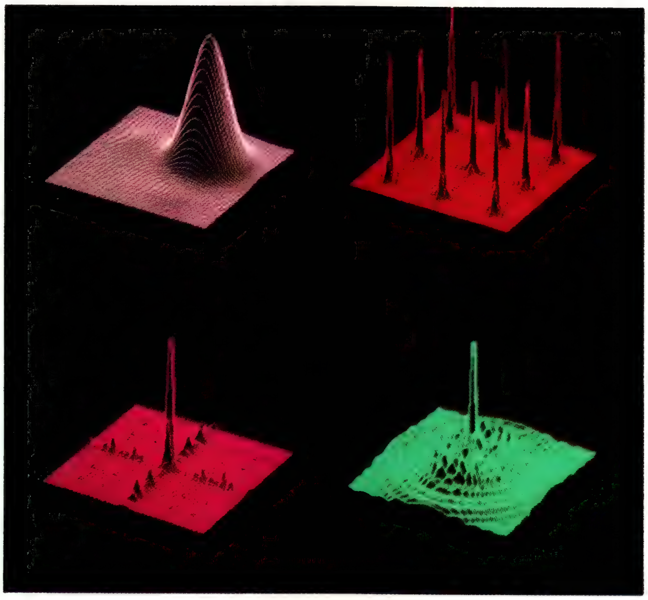
Three-dimensional plots of complex mathematical functions for antennas designed for military and space applications serve as a good example (Fig. 1). Although the data collected may appear as an incomprehensible mass of numbers on stacks of computer sheets, they become meaningful when converted into a colorful 3-d plot.

Computer graphics can be classified into two fundamental processes. In one, an object is geometrically transformed or manipulated in some form of coordinate space, and that arbitrary coordinate space is then mapped back onto the screen (see "Basics of graphics display technologies," p. 90).

The other creates a rendering, or visual representation of the object that has been described geometrically in the previous step. Visual cues are added to indicate the object's true physical structure.

To display a realistic rendering of a mechanical part, such as an automobile spark plug, it might be necessary to divide the pattern into 5,000 to 10,000 small patches, requiring up to a half megabyte of data. In computer-aided design and manufacturing, from 10 to 20 megabytes of total system data is involved in the spark plug design. Although the data base has shrunk, manipulations on the graphics data base pose a formidable computational load. To realistically render the spark plug into a graphics display will require up to 1 million floating-point operations and 5 million integer operations, repeated 30 times a second to move it dynamically. Although this capability is beyond the reach of reasonably priced current technology, the ultimate goal of computer graphics is to generate realistic moving pictures.

In concept, 3-d graphics is relatively simple: define the 3-d geometry, manipulate it into a world coordinate system, and then draw it rapidly on the screen. The fundamental operations involve rotation, translation, scaling, and perspective. In rotation, an object defined in its coordinate space is turned on at least one axis. In translation, the object is moved to a different position in the coordinate space in its same orientation. In scaling, it is simply made larger or smaller. In perspective, the effect of objects receding into the distance is simulated in a way similar to how a human eye sees an object.



1. 3-d antenna patterns. A huge mass of antenna data is incomprehensible on computer paper but, after graphics processing, provides meaningful response patterns to a design engineer.

The process of generating a polygon on the screen with smoothly varying color is referred to as shading. In a process called bilinear interpolated shading, colors are interpolated not only along a scan line (the X direction) but also from one scan line to another (the Y direction); this technique is also called Gouraud shading, after the French computer scientist who first described the method. Colors are sent for only the vertices of a polygon, with colors for the intermediate pixels interpo-

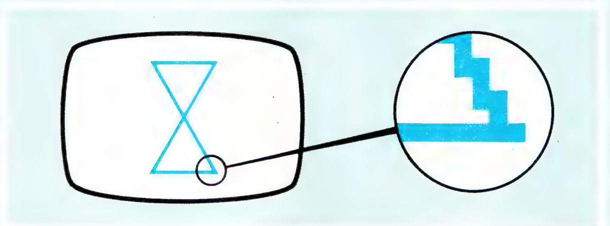
Basics of graphics display technologies

Graphics systems include three key components: displays, display controllers, and systems and modeling software. Graphics display controllers interface to a host computer and a video monitor. The controller's function is to accept data and graphics commands from the host computer and to convert this information into signals acceptable to the display device. The host computer usually performs the application functions and some graphics manipulation of data or images, or both. Some graphics controllers can free up host computer time by taking on a larger share of the processing. Graphics software includes systems software for managing interaction with the host computer and for executing, constructing, and manipulating geometric models in preparation for their display.

Three-dimensional applications are becoming more common in computer-aided design simulation and display of seismic data. A 3-d display involves drawing objects with three coordinates and manipulating their coordinates, which requires substantial applied mathematics. The selection and implementation of the correct formulas dramatically affects drawing speed, accuracy, and quality of the display, as well as the cost of the system. Solids modeling is a subset of 3-d graphics, making use of solid primitives (such as cones, spheres, cubes, and polygons) rather than 3-d coordinates to construct objects.

Currently, there are three major commercial display technologies: raster scan, direct-view storage tube, and vector refresh, each with its particular advantages and drawbacks. Raster-scan technology, the most recent entry into the graphics display field, has been the fastest growing segment over the last five years. Raster-scan technology combines conventional TV technology with digital semiconductor technology.

A raster display device has a fixed number of points, pixels, or locations, arranged in a matrix of a fixed number of rows and columns. Images are created by selectively illuminating, with an electron beam, points within the matrix. The electron beam systematically sweeps the screen, generally either 30 or 60 times per second. This process, called the refresh cycle, produces an image, all or any part of which can be modified in real time.



An important feature of raster-scan technology is that the sequence of scanning image memory and displaying it on the screen is always the same, allowing a considerable saving in the design of the monitor. Raster scan is the only display technology that allows the use of solid areas of color of varying intensity and hue. Its only drawbacks are the stairstep effect (see figure) and its marginal dynamic capability, but both of these are yielding rapidly to the continued decline in the cost of computer memory and processor chips. Because a line drawn on a raster-scan system is really a collection of dots, lines drawn on lower-resolution systems take the appearance shown in the figure. The stairstep effect resulted from the fact that early raster scan systems had resolutions ranging from only 256 by 256 pixels to 512 by 512 pixels, due to limited memory size. To increase a display's resolution from 512 by 512 to 1,024 by 1,024 pixels requires four times as much memory, which made such systems prohibitively expensive five years ago. Today, it is possible to deliver a raster-scan system with a resolution of 1,024 by 1,024 pixels for less than the price of a direct-view storage tube system.

Direct-view storage tubes were pioneered by Tektronix Inc., Beaverton, Ore., in the late 1960s. In this system, the image is written with a sharply focused electron beam and is kept illuminated with a diffused flood beam and a long-persistence phosphor. When they were introduced, direct-view storage tubes offered major advantages as graphics devices. They were less expensive than available alternatives, required no major auxiliary electronics beyond the deflection and power circuitry of the storage tube itself, and were very accurate, with good resolution and the ability to draw visually smooth curves. Storage tubes are still the preferred technology where the sole concern is the display of extremely fine detail in line drawings.

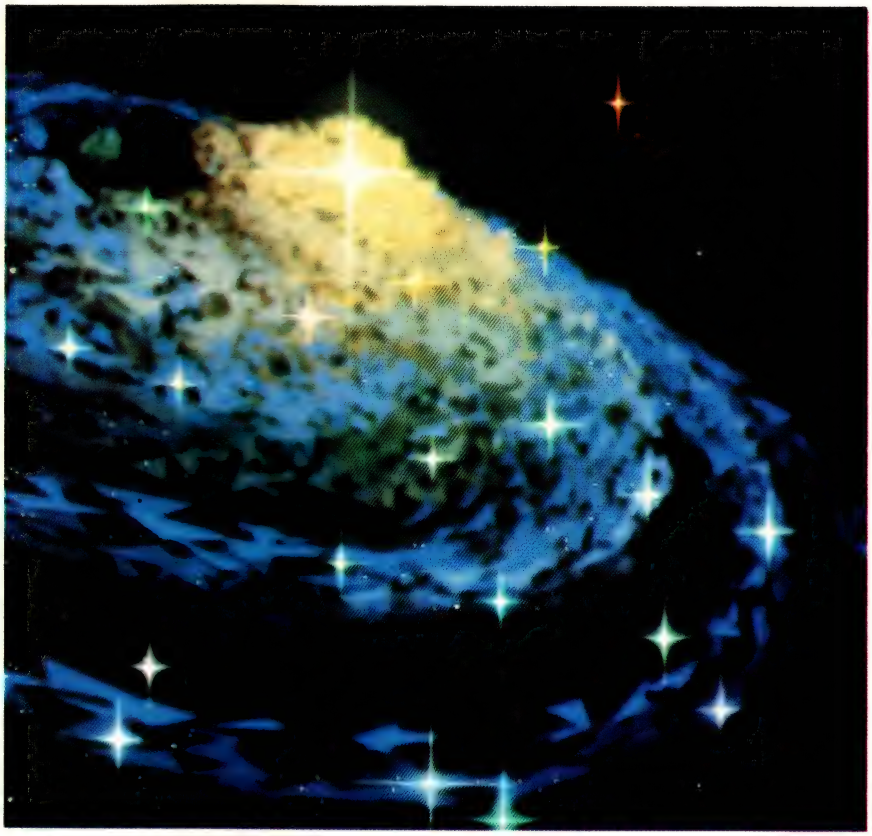
The storage tubes' major disadvantage is their inability to selectively update a portion of the screen; the only way to change the image on a direct-view storage tube is to totally erase and rewrite the image. Other problems include lack of color and the inability to fill solid areas on the display. Although the basic storage tube is limited to a single color, recent innovations have extended this to two or three. Because it writes only fine lines, it fills in a solid area only as a pattern of fine lines. These drawbacks have left the storage tube in a poor competitive position.

In a vector-refresh system, the image is redrawn from 30 to 90 times a second on a display tube. Because the list of lines displayed is maintained in a special local memory, it is easy to change the image's appearance or to move it around the screen by modifying the elements in the local memory. The local display processor, a computer optimized to traverse this list and control the monitor's analog deflection circuitry, can easily modify these entries at high speed (1/30 to 1/60 of a second).

Vector-refresh technology predates the direct-view storage tube and has the same visual advantages, including fine-line rendering and smooth curves. In addition, it can update displays selectively and adds a capability for dynamic motion of images that raster-scan technology is just beginning to approach.

However, vector refresh has two major disadvantages: price and color capability. The vector-refresh display tube is expensive, requiring precise high-speed analog circuitry, and it demands a dedicated local processor to maintain and constantly redisplay its local display list. Although vector-refresh systems can display colored lines through the use of highly modified shadow mask tubes, they still cannot fill solid areas in either monochrome or color.

2. Making points. This image of a galaxy, done by depth buffering, appears very realistic. Using the same data base with wireframe rendering would produce an unintelligible display on the graphics screen.



lated to fill the polygon.

The development of improved rendering techniques is a major focal point for current graphics research work—the goal being the ability to produce a realistic image. Currently, three main types of renderers are in use in the industry: the wireframe, the depth buffer, and the ray tracer.

The wireframe renderer, the simplest technique, is a type of drawing in which the edges of objects are filled with lines; surfaces are either not filled in or are lined with cross hatching. The major problem in this approach is handling hidden lines, a computationally intensive procedure. The example of a galaxy, shown in Fig. 2, would be incomprehensible in a wireframe outline but appears quite realistic when more sophisticated rendering techniques are used.

The rod-and-ball picture in Fig. 3a is a wireframe-rendered image. Although the varying brightness of the lines gives some clues as to the part's 3-d geometry, there is still considerable ambiguity. It is not entirely clear on which side of the rod the balls are located—especially at the bottom, where a confusing little wheel pattern appears. Wireframe renderers are very fast and, most important, can be used with existing vector writers and storage tubes, making this technique the only renderer that can be used with all existing graphics technologies.

System disadvantages

The main disadvantages are that the displays don't look as realistic as those of other techniques; also, details can get cluttered, and the removal of hidden lines imposes a substantial computational overhead on the system. A concern with wireframe renderers is that they produce displays that describe solid objects with an ambiguous front-and-rear orientation; this poses a major problem when examining complex mechanical parts.

One technique used to circumvent this is hidden-surface removal, which is the process of drawing only the visible surfaces of a solid object. This is typically a time-consuming operation on the host computer; offloading it to the local graphics system improves total system performance. One method of hidden-surface removal is the depth-buffer algorithm, or depth-buffering. In depth buffering, physical depth data is added to the image array, which contains color information for each pixel. Though it can be fairly complex to efficiently implement this technique, the concept is fairly straightforward.

In depth buffering, the visible screen of a graphics terminal is viewed as a long, narrow, box measuring 640 by 512 pixels in the X and Y dimensions, with depth, or the Z dimension, extending back into the screen. This Z dimension can be as long as 65,535 units.

To work with depth buffering requires basic two assumptions. First, when this long, narrow box is viewed from an infinite distance, there is no perspective; things at the back of the box (farthest from the screen) will look as large as things in the front. Second, a memory area exists, separate from the image memory, which contains the depth, or Z value, for each pixel on the screen.

With these basic assumptions, the Z value of all pixels is set to the maximum value. The depth memory now thinks that there is a solid surface across the farthest end of the visible box. Since the image memory has nothing in it, the screen shows nothing. Next, a polygon is written into the image memory. Each pixel that makes up the polygon depth is compared with the value already in the depth buffer for that location.

If the new pixel's value is less than the existing value, it is written into image memory and its Z value is substituted for the old pixel's Z value in the depth buffer. Because all locations of this buffer have been preset to the maximum value, all the polygon's pixels are written. Z values for pixels other than those at the polygon's vertices are determined by bilinear interpolation of the vertex values. In fact, the algorithm is almost identical to that used for color interpolation.

If a Z value is greater, the new location is farther away than the existing location. Because it is farther from the screen than the existing pixel at that X-Y coordinate, it should be hidden and is therefore not written. If, on the other hand, the Z value is less than the existing pixel, it is closer to the screen and should hide the previous pixel. Therefore, the new pixel is written and its Z value replaces the previous value.

The effect is that the screen displays only the visible surfaces of the polygons that have been sent, with the hidden surfaces properly removed. When this process is combined with smooth shading, realistic representations of 3-d objects appear with minimal host involvement after the polygonal data base has been constructed.

In addition to the elimination of host overhead, the depth-buffer technique offers a very important advantage for interactive applications: the surfaces need not be in any predetermined order, conserving host time by eliminating a time-consuming sort phase and allowing objects on the screen to be incrementally constructed.

More geometric information

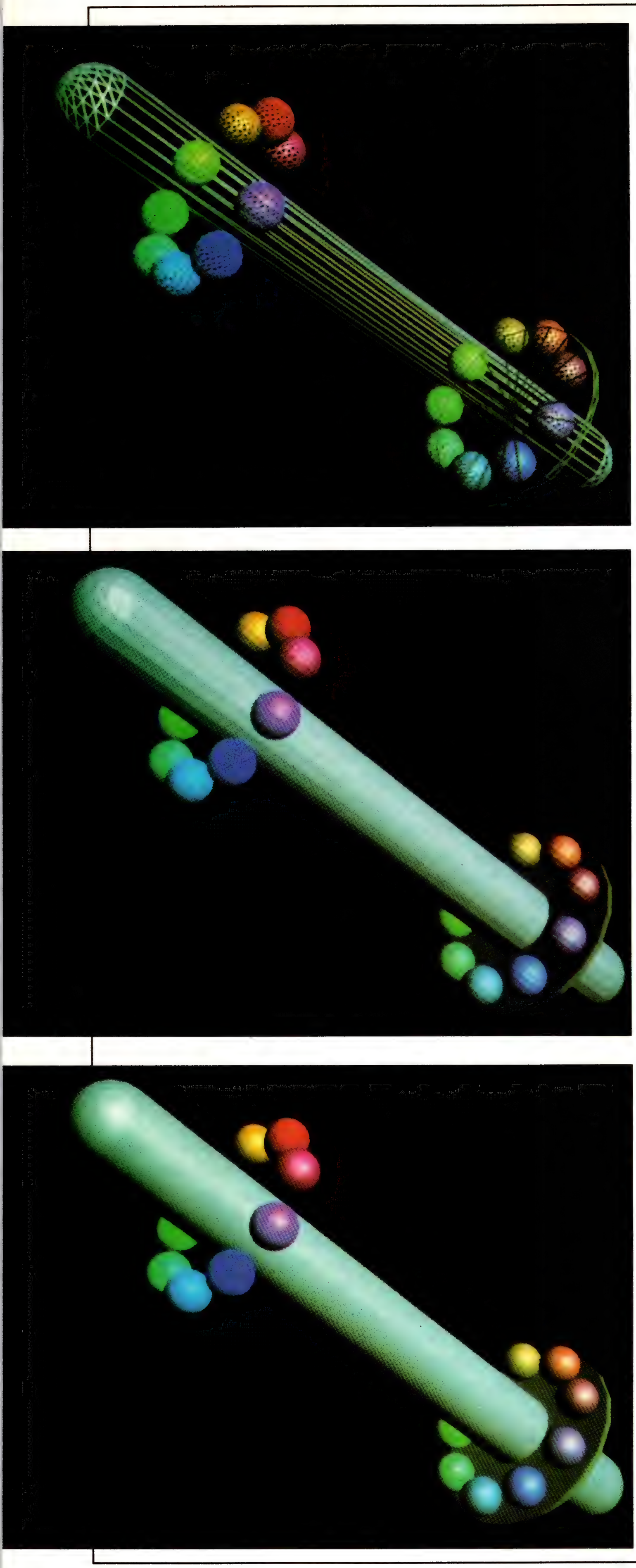
There is a much larger amount of geometric information in the depth-buffered rendering (Fig. 3b) than there is in the wireframe rendering (Fig. 3a). Despite the fact that the same data base was used to generate both displays, there is now no ambiguity about which pieces of the object are in front and which are in back—that is, the object's geometry is now very clearly specified. Rather annoying small flat surfaces still exist, however, leaving room for further improvement.

Two major advantages of a depth buffer are that it is fast, with rendering speed roughly proportional to the number of pixels written. Modern graphics systems in the $20,000 to $30,000 range have depth buffering and can shade a 5,000-patch, 640-by-512-pixel model in from 2 to 5 seconds. In addition, it is relatively easy to implement either in hardware or software, is easy to code, and can take most types of object descriptions—especially polygons, which have become the *de facto* standard for the primitive of choice for different types of renderers.

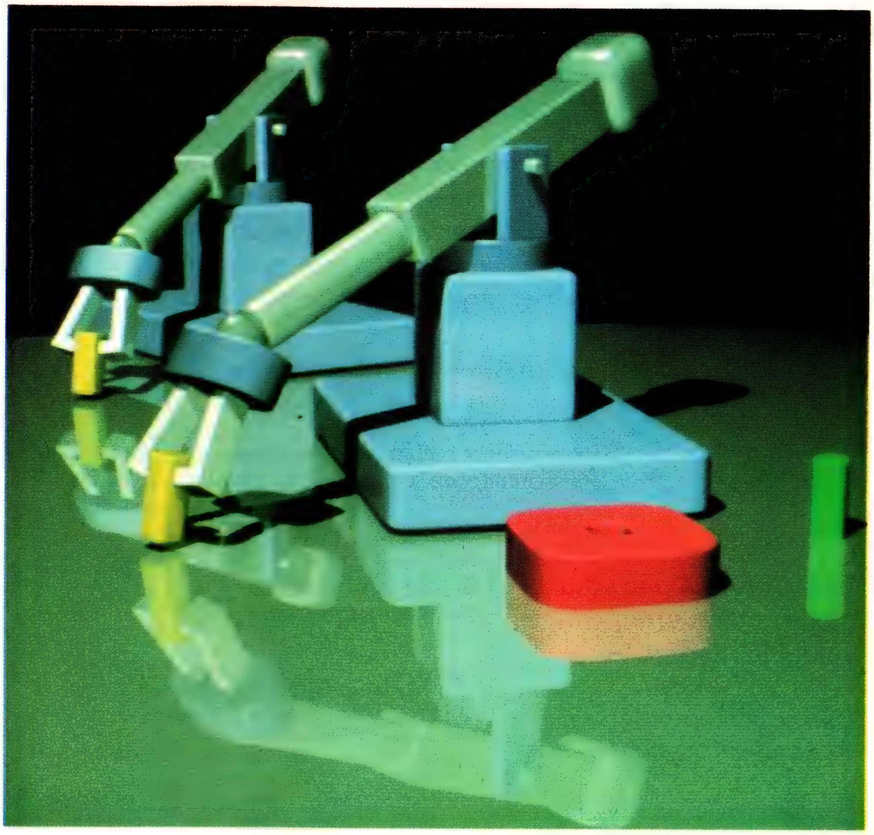
The main disadvantage of a depth buffer is its intensive demand for memory. For every pixel, regardless of how many bits of color, anywhere from 12 to 16 bits of memory are required to adequately store the depth information. Fortunately, this is becoming less critical as memory costs drop. Minor problems are the depth buffer's inability to handle reflections or transparencies, and the need for two passes and a duplicate depth buffer to generate shadows.

Brightness interpolation, also referred to as shading, is essentially a technique for fooling the eye into believing that flat patches are round. This method works well because the most important clue that the human vision system uses to determine an object's shape is the variation of light along its surface; when the polygon's color is varied, the eye can be deceived into believing that an object with flat facets instead curves smoothly.

The display shown in Fig. 3c, using the same database as the wireframe and the depth-buffered techniques but interpolating the colors between the polygon's vertices, is a more realistic rendering of a rounded object. There is no additional information available to the processor for this rendering, as opposed to the flat-shaded or the wireframe versions, but simply a matter of how the data is interpreted by the processor. This point has significant



3. Eye on the ball. With wireframe rendering, there is ambiguity about the location of the balls at the bottom of the rod (a). The depth-buffering technique (b) improves the image, while brightness interpolation (c) adds considerably more realism to the display.



4. Ray tracing. A very realistic image such as this robot assembly can be produced by ray tracing, which involves hundreds of millions of floating-point operations, requiring up to eight hours on a VAX 780-class computer.

implications for partitioning graphic applications between the host and the local terminal or controller to permit offloading from a general processor to a specialized processor.

Ray-trace rendering, the third technique, may be described as tracing a ray of light from the viewer's eyepoint to each possible pixel on the screen. If the ray encounters a solid object, the user checks to see if it is reflective or transparent. If it reflects, the user creates a new ray; if it is transparent, he bends the ray and proceeds. This process can continue through several iterations with rather spectacular results (Fig. 4). Extremely realistic renderings are generated with considerable control over factors such as surface texture, reflection, and transparency. The advantages of ray tracing are its high-quality pictures and the wide variety of visual effects possible. The technique does not require much memory, so memory cost can be quite low.

The main disadvantage is its slow speed. Hundreds of millions of floating-point operations are required to generate images such as shown in Fig. 4. To make this point clearer, the shaded polygonal rendering of the rod and ball of Fig. 3 required about one second with depth buffering and could take hours with ray tracing. The ray-traced display of robot arms in Fig. 4 took about eight hours on a Digital Equipment Corp. VAX 11/780-class machine, because the technique is so computer-intensive.

Another disadvantage is that ray tracing is usually restricted to mathematically defined objects because the process of checking for intersection between the ray and an object requires solving an equation to determine if that ray is inside or outside an object. This restriction poses problems with data bases that cannot be described with a mathematical formula. Finally, ray tracing is very difficult to implement in hardware, which means that the possibilities for building specialized processors to bring costs down and performance up are more limited or more expensive than for other rendering techniques.

Choosing the best technique

Which graphics technique is optimum depends on the intended application, which is different for an end user, a work-station integrator, or an original-equipment manufacturer; there is no universal solution. For the end user, the considerations are relatively straightforward; a decision has to be made whether to invest in an integrated work station or opt for a modular add-on graphics package that can be upgraded over the lifespan of the system.

For original-equipment manufacturers, the decision to make or buy accessories or peripherals have been traditionally dictated by cost, design integration challenges, and time to reach the marketplace. For the low-end graphics market, there are enough merchant market parts (such as vector generators and bit-slice processor video random-access memories) for a technically competent OEM or work-station manufacturer to build low- to medium-performance graphics systems.

High-end graphics systems are a different challenge because they are, in a sense, a moving target. Special skills are required to create algorithms, VLSI chips, and analog circuitry to produce leading-edge graphics. Although graphics algorithms are well described in literature (except for the latest research in ray tracing), the issue is not the design of the algorithm but its implementation—making the algorithm fast and efficient within reasonable memory size and systems cost. The high-end graphics designer must have a feel for which of the algorithms should be contained within the VLSI chip and which should be left in soft logic, since they could be changed or be superceded by improved algorithms.

The last issue is analog engineering, since the design and fabrication of 100-MHz and higher video output circuitry for 1,000-line, 60-Hz and better systems have posed a bottleneck in the implementation of high-end graphics. Although a number of dedicated graphics vendors have been supplying 60-Hz, 1,000-line systems for some time, none of the work-station vendors are. The reason lies in the concentration of graphics suppliers on analog engineering, while work-station designers are coping with integrating disks with controllers and operating systems and compilers.

Richard Fichera is director of marketing at Raster Technologies, No. Billerica, Mass.

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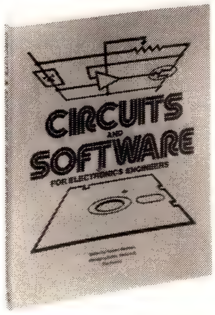

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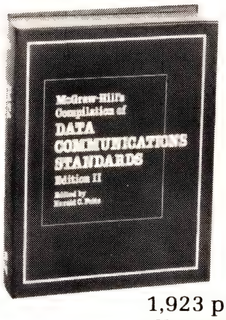

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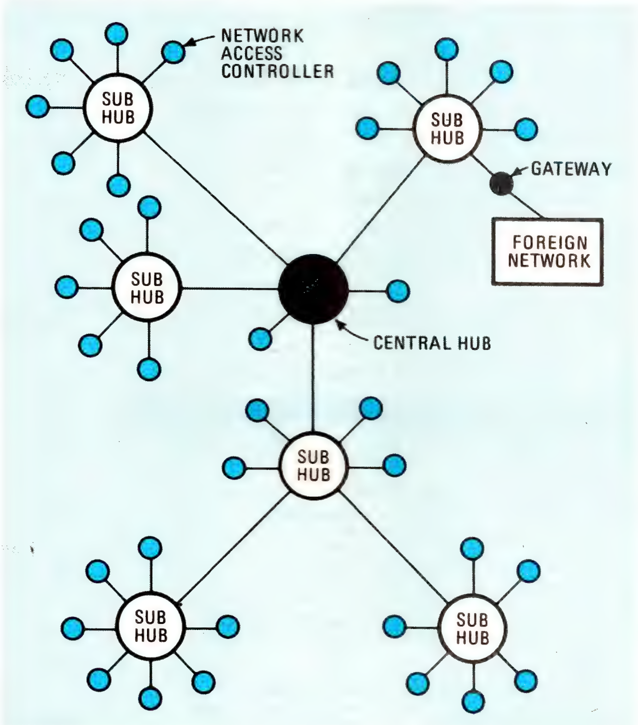
HIGH-SPEED NETWORK USES FIBER OPTICS

By using fiber optics, a new local network provides the capability for high-speed, efficient data transmission

☐ *by Harvey Ikeman, E. Stewart Lee, and Peter I.P. Boulton*

A novel 50-Mb/s local network has been developed to satisfy the demand for faster and more efficient LANs while taking advantage of the well-known benefits of fiber-optic transmission. Hubnet, which is contention-based, consists of a set of hubs arranged in a rooted-tree topology connected entirely with point-to-point fiber-optic links (see Fig. 1). In any Hubnet, one central hub forms the root of the tree, through which all communications ultimately pass. The other hubs, called sub hubs, cascade down from the central hub, connected through 50-Mb/s duplex fiber-optic links. Each hub provides a means of connecting host computers or other machines to the network.



1. Rooted-tree topology. Hubs connect in a rooted-tree structure; the central hub is the tree's root. Network access controllers provide the host or device interface. Hub-to-hub and network-access-controller-to-hub connections are duplex 50-Mb/s fiber-optic links.

The network's size and the number of attachments can be increased by adding hubs to the tree structure. An efficient low-level-access protocol gives it low delay and excellent load-handling. Hubnet, the result of a project carried out by researchers at the University of Toronto, offers performance levels matched by few networks, but is nonetheless implemented with little difficulty.

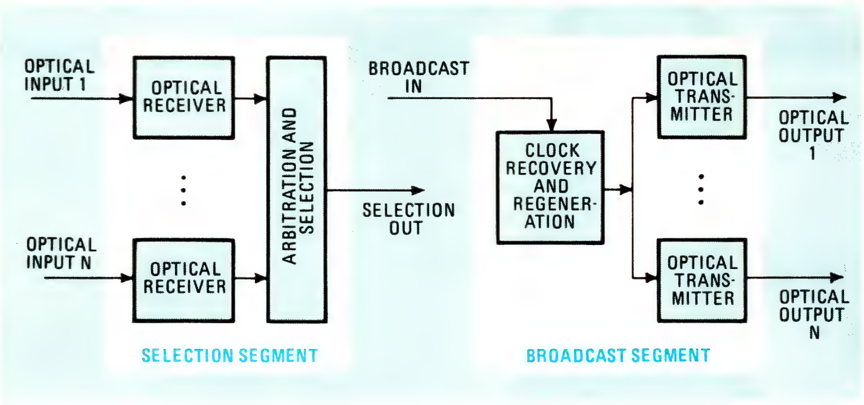
Since fiber optics was the selected communications medium, various network topologies were considered to fully utilize its capabilities. First to be examined was the topology typified by such coaxial-cable-based carrier-sense multiple-access with collision-detection systems as Ethernet. This configuration was not suited to fiber optics, since optical taps or splitters do not distribute power efficiently in a bus topology.

A second topology considered was a fiber-optic star coupler that transforms the network into a broadcast star, gives more users access to the system, and enables it to have better performance and improved flexibility. This topology, however, restricts the number of attachments that can be supported. In addition, CSMA/CD protocols impose limitations on network size and on minimum packet length, as well as place demands on the dynamic range and acquisition-speed requirements of receivers.

Since such factors can limit the performance of high-speed networks, this topology was also unacceptable. Although ring networks were also considered, reliability and survivability considerations called for complex or expensive measures to achieve acceptable levels of performance with this format, so that this choice also could not be used.

To satisfy the project's goals for network size, number of attachments that would be possible, and ease of expansion, point-to-point fiber-optic links and active electronics were selected as the approach. Table 1 compares the characteristics of Hubnet with those of a 10-Mb/s CSMA/CD network as specified by the IEEE 802.3 standard.

Functionally, a hub comprises a selection segment and a broadcast segment (Fig. 2). The selec-



2. Hub functions. The hub's selection segment chooses packets on a first-come, first-served basis, with only complete packets passing through. The broadcast segment retimes and regenerates the input data and broadcasts it on all outgoing ports at once.

tion segment has a number of 50-Mb/s optical receivers, arbitration and selection logic, and a single output available in either electrical or optical format. In the case of a central hub, the output is electrical; for a sub hub, it is optical. Arbitration logic controls the contention process. Operation will be described on the assumption that the network is in an initial idle state—that is, no packets are being transmitted.

An optical receiver detecting a packet's arrival requests access to the selection logic. If this is the first incoming packet, it is selected and the packet is switched to the output, a bit-serial data bus. Subsequent packets arriving on other hub input ports are ignored while the current packet is being served.

Packet-starts

Depending on whether the hub is a central or a sub hub, the selected packet is put out in either electrical or optical format. When it ends, the arbitration and selection logic is re-initialized. Any new packet-start will now contend for access to the selection logic output.

The first new packet-start received will be selected, and any additional packets arriving subsequently at the other ports of the hub will be blocked. If two or more packets arrive simultaneously when the selection logic is free, the arbitration logic resolves any potential collisions and allows only one packet through. This selection process is made within two bit-times (20 ns/bit at 50 Mb/s) during the packet header interval.

Only complete, fully formed packets ever pass through the hub. Therefore, although there is contention for access to the hub, collisions are resolved quickly. One packet is selected while all others are blocked and are forced to try again later. The hub-selection process works constructively: that is, by resolving collisions, it always selects a packet for transmission.

In a central hub, the output of the hub's selection segment feeds the input to the broadcast segment, a connection that is made at electrical levels. In sub hubs, the selection output and broadcast input are made at optical levels and provide the means of interconnecting hubs. The hub's broadcast segment consists of a single 50-Mb/s input, either electrical or optical, clock recovery and data-retiming circuitry, and a number of optical outputs. The input data is retimed, regenerated, and broadcast onto all outgoing optical outputs.

Cascading hubs

Hubs are cascaded (Fig. 3) by connecting the hub's selection segment output to an optical input of a more central hub, over an optical path, with the data transmitted in a bit-serial stream. The selection segment output of this hub is, in turn, connected to an even more central hub, until the last sub hub transmits directly to the central hub. In the central hub, the selection segment output is applied directly, over an electrical path, to the broadcast segment. The central hub's outputs are broadcast through the subhubs to all network access controllers in the net, including the originating network access controller.

The rooted tree network has a dual path. The upstream one, from sub hubs to the central hub, works through a contention and selection process; the downstream one, from the central hub through the network, is a straightforward broadcast mechanism.

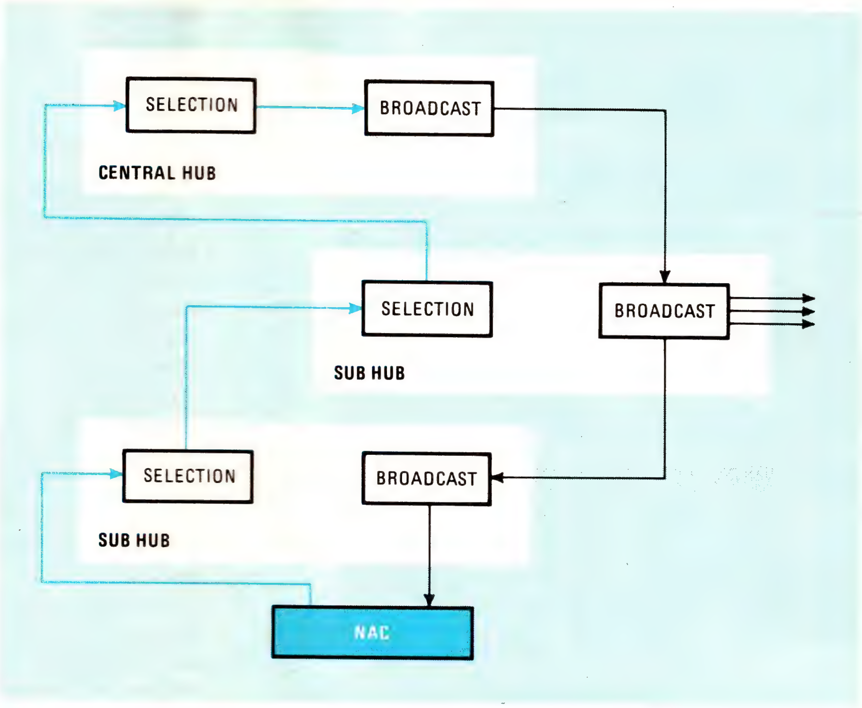
Clock recovery and data retiming are performed at each hub to minimize clock jitter and maintain negligible error rates in large networks. The delay through a hub for selected packets is about 250 ns, which is small when compared with the network's typical propagation delays. There is no address recognition logic or any other provision for allowing local switching or routing. All logic functions are performed by a handful of integrated circuits. By design, hubs have been kept simple for maximum reliability and minimum delay.

Network access controllers provide a means of attaching a host computer or other machine to the network.

A COMPARISON BETWEEN HUBNET AND THE IEEE 802.3 CSMA/CD STANDARD

	HUBNET	IEEE 802.3
Data rate	50 Mb/s	10 Mb/s
Physical medium	Glass fiber	Coaxial cable
Maximum link distance	2 km	500 meters per segment
Maximum network size	Open	2.5 km
Topology	Rooted-tree	Bus (or optical-based star)
Maximum number of stations	65,536	1,024
Link protocol	Multiple access, collision avoidance, echo detect and retry	Carrier sense, multiple access with collision detect
Minimum packet size	9 bytes	64 bytes*
Maximum packet size	4-K bytes	1,518 bytes*

*excluding 8-byte preamble



3. Cascading hubs. The optical output of the sub hub's selection segment connects to an optical input port of a more central hub. In turn, the corresponding optical output of the more central hub connects to the sub hub's broadcast input port.

Such a controller consists of a host-specific interface, separate transmit and receive buffer memories, control logic that carries out Hubnet low-level protocols, and a 50-Mb/s optical interface to the network (Fig. 4). The controller comprises two separate units: the controller module, which plugs into the host computer, and the transceiver, which provides the electro-optic network interface. A ribbon cable connects the two. (A controller designed for Multibus-based host computers and its associated transceiver has been built.)

This class of network access controllers implements Hubnet's physical, data-link, and lower network-level protocols, while the host runs higher-level communications protocols. The controller's low-level protocols provide a best-effort delivery system; the higher-level protocols guarantee message delivery.

Controller operation

A packet, including destination and source address fields, is assembled in the network access controller transmit buffer. The controller completes the packet by appending a header and a cyclic-redundancy-check field as well as an end-of-message sequence. The signal is converted to optical levels and transmitted to the network at 50 Mb/s. There is no carrier sense or listen-before-talk mechanism: when the controller has a packet ready to transmit, it does so.

In the receive direction, the controller monitors all incoming messages. On examination of the address fields, it stores only those packets intended for it in the receive buffer. After recalculating and validating the CRC field, the controller notifies the host that a valid packet has been received; the host then reads the data and carries out the higher-level communications protocols.

Each network access controller has a unique address or set of addresses to fix its relationship to other such controllers in the network. The addresses of both source and destination controllers are embedded in the packet, along with other synchronization, address, control, and mode fields.

Hubnet's message format (Fig. 5) includes an 8-bit header field, a unique pattern that tells the receive logic in a hub or network access controller that a packet-start has arrived. Destination- and source-address fields, 16 bits each, follow. The 16-bit mode field specifies the message's type and format and has various control bits used by higher-level communications protocols. Optional fields may follow, depending on the mode field's value.

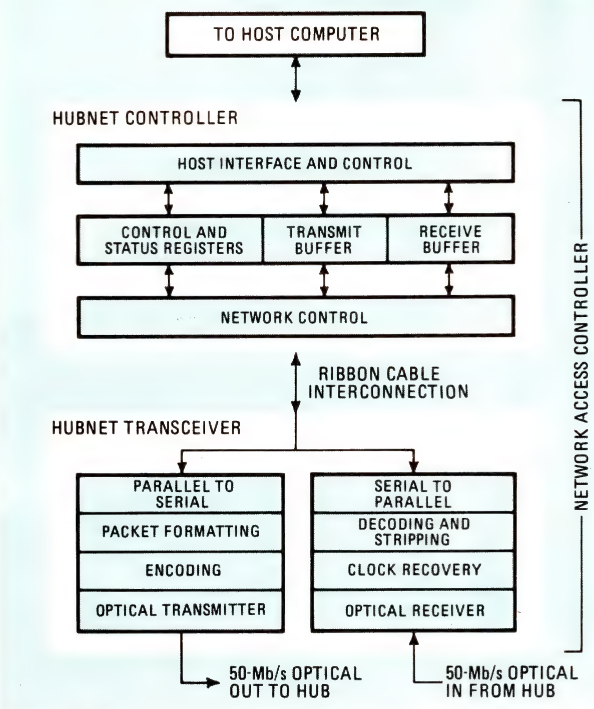
The data field, which may be nonexistent (0 bytes) or as long as 4-K bytes, carries the message information, followed by a 16-bit CRC field. A unique end-of-message sequence terminates the packet. Except for the header and end-of-message sequences, the packet is encoded in a Miller-type code to ensure high transition density and good dc balance.

The host computer or user attachment to Hubnet is provided by network access controllers connected to the hubs at any level of the tree structure. They, too, use 50-Mb/s fiber-optic links. The fundamental concept behind Hubnet stemmed from the realization that if a bus is shrunk down to a point (or to several inches of wire on a backplane), it is possible to detect and either resolve or avoid collisions of packets arriving at that point from different sources as shown in Fig. 2. The hub acts as a traffic cop by monitoring incoming packets and guaranteeing that only one, in its entirety, is passed through the network.

Packet to hub

As soon as a network access controller has a packet ready, it is transmitted to the hub serving that controller. The hub will select this packet only if the selection side is receptive, and this is the first new packet-start received. Provided that this first-come first-served condition is met at all intermediate hubs, the packet works its way up to the central hub, but it can be blocked at any hub as it passes through the system. Once the packet reaches the central hub and has been selected by it, it has successfully captured the network. On the broadcast path of the tree structure, the packet is then transmitted to all network access controllers throughout the network, through the subhubs, including the originator.

When the originating controller hears its packet echo back within the expected round-trip time, it knows that it has successfully acquired the network and assumes that the destination controller received the packet as well. The controller has only to examine the packet's address fields to make a decision; if the source-address matches

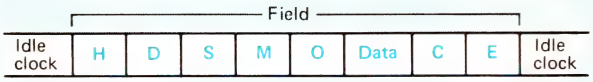


4. Network access controller. The network access controller, installed in the host computer bus, carries out the low-level Hubnet protocols. The transceiver provides a 50-Mb/s optical interface to the network. A ribbon cable connects the two units.

the local one, it means that the packet is an echo.

If the originator does not receive an echo within the expected round-trip time, the network access controller concludes that it did not acquire the network. Ongoing transmission is aborted, and the controller immediately retransmits the packet stored in the transmit buffer. There is no back-off or waiting period; the controller continues to retry at round-trip intervals until it has acquired the network (as signaled by the echo detection) or reached a preset retry limit.

On receiving a packet addressed to it, the controller recomputes the CRC field, which it compares with the one that has been received. Any discrepancy will cause the packet to be rejected. Valid packets are stripped of the header, CRC, and end-of-message sequences and then placed in the receive buffer, where they are made available to the host.



H	Header	8-bits, 7 highs followed by 1 low
D	Destination	16-bit Destination Address
S	Source	16-bit Source Address
M	Mode	16-bit Mode field
O	Optional Fields	
Data	Minimum Length Maximum Length	0 4-K bytes
C	Cyclic redundancy check	16-bit CRC field
E	End of Message signaled by 3-bit shutdown sequence followed by 6 consecutive lows.	

5. Message format. Except for the 8-bit header, all fields are 16 bits. The message includes several fields: destination and source address, mode, optional extension, variable-length data, and cyclic-redundancy-check. An end-of-message sequence signals the packet's end.

Design considerations

When Hubnet's original goals were chosen, they included a 50-Mb/s transmission rate, since it represented comfortable technological and cost thresholds. At this bit rate, the use of high-speed emitter-coupled logic is required only in the serial data paths and clock recovery logic. Low-cost electro-optic sources and detectors can be used.

The network access controller's design makes possible extensive use of programmable logic arrays. As a result, it achieves a fairly high logic and packaging density yet allows logic changes to be made easily; new PLAs can be programmed. The hub uses ECL logic chips throughout, since it handles 50-Mb/s data streams and 100-MHz clocks.

Hubnet is a master-clocked network. A master clock generated in the central hub provides a time base to all sub hubs and network access controllers. The timebase reference is inherent in the signal continuously broadcast. Outside of packet transmission, a 25-MHz idle clock is broadcast to ensure that all hubs and controllers receive a constant signal from which to derive the network master clock. Packets are encoded in a high-transition density code to maintain clocking information during transmission. All packets transmitted by the controllers are clocked by the locally derived 50-MHz system clock and arrive at the serving hub, frequency synchronous to, but in arbitrary phase with, the hub clock.

The selected packet undergoes a phase-alignment process undertaken in the 8-bit header period. The packet is then retimed and broadcast, but not before the 8-bit header has been fully refreshed to ensure that it can be recognized at the next hub or controller. This synchronous mode of operation eliminates the need for fast-acquisition phase-lock loops and keeps the header size to a minimal 8-bit field.

Optical receiver design has also been greatly simplified, since a signal—the 25-MHz idle clock or the encoded packet—is always present on all Hubnet links. This arrangement allows the receiver to be ac-coupled for maximum sensitivity and provides for the establishment of an optimum decision-biasing level. An indication of link integrity and receive power level is provided as well. The absence of a receive signal is detected and drives a light-emitting-diode alarm indicator, allowing faults to be located and repaired quickly and easily.

In high-security applications, where surreptitious tapping of or tampering with the optical cable may be a concern in system operation, a voltage test point can monitor the received power level. Rapid or unusual changes may mean an attempt to compromise the system's security. Hubnet optical links use an LED source and a p-i-n detector operating at 820 nm.

Provided that the link bandwidth is greater than 50 MHz, fiber-optic links can use 50-, 85-, or 100-μm-core graded-index fiber. Link spans (hub to hub or hub to network access controller) of up to 2 km are achieved using suitable low-loss fibers.

Hubnet permits the network access controllers and hubs to be configured according to the application. Although the network always operates as a rooted tree, the physical configuration can take many forms. Each hub can handle up to 11 optical ports. In a central hub, any optical port can serve a controller or lower-level hub; in a sub hub, one optical port is assigned to handle connections to a higher, more central hub.

A star-like arrangement, with all hubs located at a central site (Fig. 6a), may be suitable if all network access controllers are within range (2 km) of the central site. Since all hubs are in one location, maintenance and fault-location are centralized. In a linear network (Fig. 6b), hubs are strung together and act as repeaters in a bus-like structure. Each hub provides a number of local network access controller attachments.

In Hubnet, there can be only one active central hub, but any number of sub hubs is permissible. The network's actual topology depends on several factors: the number, distribution, and concentration of network access controllers, the desire to place hubs in locations that offer both security and easy access for maintenance, the 2-km length restriction on fiber-optic links, and cabling considerations.

Large networks with several levels of hubs can serve hundreds (or thousands) of controllers. The network's addressing capability (65,536) is unlikely ever to be a limitation. Network overload, resulting in delay times that are unacceptable to the network access controller, is more likely to be the limiting factor. It can be overcome if the network is subdivided into two or more networks and gateways are used to bridge them.

Network access controllers closer to the central hub will hear their packets echoed—or not echoed, as the case may be—sooner than controllers farther away. Thus, if allowed, the more central controllers will be able to retry more quickly than their counterparts and will therefore have a better chance of acquiring the network.

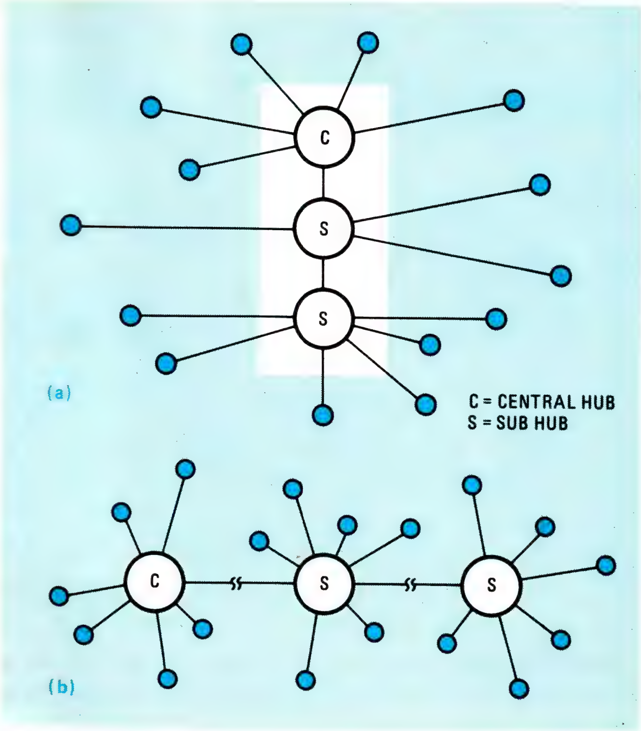
Retry rates

A high degree of fairness can be forced on the network if all controllers are programmed to the retry rate established by the round-trip time of the controller farthest from the central hub. On the other hand, certain controllers can be given favored status if they are located at the central hub and programmed for the highest possible retry rate. The network administration function and certain types of file or print servers may benefit from attachment to favored controllers.

In practice, however, most Hubnets will operate under light loads, and the effect of altering the retry rate will be small. For optimum performance on heavily loaded networks, the controllers' retry rates can be fine-tuned for desired performance characteristics.

Since all Hubnet's optical links carry a continuous active signal, notification of link failures (loss of signal) is immediate. Taking advantage of this feature, sub hubs can automatically revert to the central-hub mode and serve the subnetwork below if a higher-level interhub link failure is detected. Restoration of that link will switch the hub back to sub hub mode. Figure 7 shows an example of network partitioning.

In normal operation, packets work their way up to central hub A for ultimate selection and broadcast through the network. If a failure occurs and sub hub B no longer receives a signal from central hub A, sub hub B goes into the central-hub mode and the network appears as two independent networks. When the fault is corrected, the network is automatically restored to the original configuration.



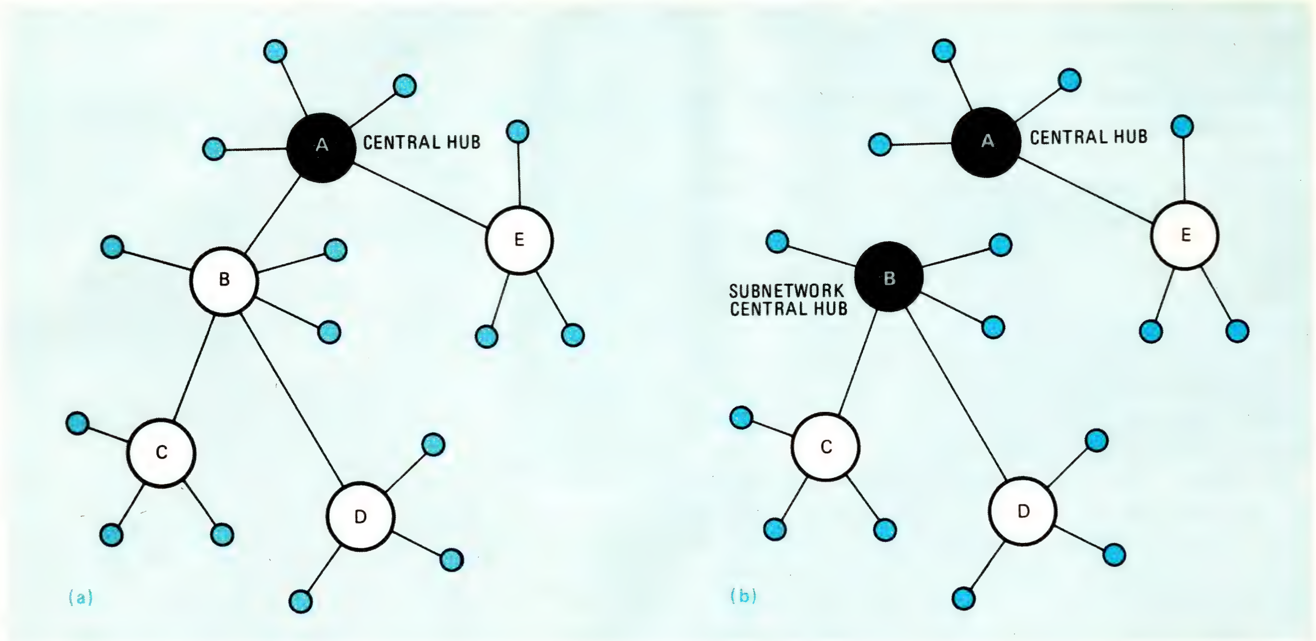
6. Two Hubnet configurations. In (a), all hubs are at a central location, which facilitates maintenance of the system. In (b), hubs are connected in a bus-like network. Either way, the network operates logically as a rooted tree.

Alarm indicators are provided at the hubs and network access controllers to indicate individual link activity and receive power level, in addition to network synchronism status. If a failure occurs, it can therefore be located and fixed easily.

Hubnet low-level protocols are carried out by hard-wired finite-state machine logic in the network access controller, so these protocols can cycle at full network speeds. Controller data throughput is limited by the host protocols, not by any network hardware. The message format is functional and well suited to high-speed network operation.

Any one of the established or emerging standards can act as higher-level protocols for use in Hubnet. The Defense Department's Transmission Control Protocol/Internet Protocol can be run with an appropriate software driver and has been demonstrated on a Hubnet interfaced to a VAX 11/750 computer.

In Hubnet, transmission delays do not become significant until more than 70% of the available capacity of 50 Mb/s has been used. A delay is considered significant if it exceeds a packet transmission time by an order of magnitude. Since the network is always doing constructive work—that is, there are no destructive collisions or other bandwidth-wasting properties—network saturation is achieved at 90% to 95% of capacity. In addition,



7. Networking with link failures. In the event of a break in the link between sub hub B and central hub A in the original network (a), hub B becomes the subnetwork central hub, and the network splits into two functional subnetworks (b).

momentary overloads are handled well, thanks to the way Hubnet shares the available bandwidth.

Hubnet's attributes are suited to a wide variety of applications. Its high capacity and performance characteristics allow high-speed host-to-host or host-to-peripheral communications. When used to connect a variety of hosts, work stations, terminals, and other machines—or when configured as a backbone network tying LANs together over an entire campus or office-industrial complex—hubnet has the size, addressing range, and flexible topology needed to handle the job.

Exclusive use of fiber-optic links gives the network the electromagnetic interference immunity and high electrical isolation required for industrial applications. The security aspect of fiber optics is important to military, governmental, and financial applications.

Can handle broadband

Although Hubnet is a baseband network, the optical-fiber links have a broadband capability. No provision has been made for handling high-bandwidth full-motion video directly through Hubnet; because the system is contention-based, a maximum delay cannot be guaranteed. However, Hubnet fiber links can be used to carry additional digital or analog information channels if wavelength-division-multiplexing techniques are used.

In wavelength-division multiplexing, multiple services can be carried on a single fiber if each is transmitted at a different wavelength in the optical spectrum. Wavelength-selective filters sort the respective information streams out at the receiver ends. Point-to-point optical links can therefore serve non-Hubnet traffic from site to site. Users can consider this operation as an analog network superimposed on Hubnet's tree structure—sharing the fiber links, for example.

If fault tolerance is a requirement, or if improved reliability is necessary, Hubnet's performance can also be enhanced through the use of replicate hubs. An active/standby or primary/secondary relationship can switch in redundant hardware or provide alternate paths in the event of a hub or link failure.

Hubnet's concept, though conceived in a 50-Mb/s implementation, is not limited to this speed. The network protocols, packet format, and configurations are not a function of bit rate. A Hubnet operating at 100 Mb/s, or at even higher rates, can offer exceptional levels of performance yet retain flexibility and simplicity in its approach. In much the same way, a Hubnet operating at 10 Mb/s can offer significant performance advantages over CSMA/CD networks operating at the same rate, yet it can still be cost competitive.

Hubnet represents a new approach in high-speed networking. Although the network is well suited to a wide range of LAN applications, it continues to retain relative simplicity in operation, while still achieving high levels of performance. Other high-speed networks, primarily based on token-passing rings and also offering fiber-optic options, have been announced recently, or are known to be in development.

With the movement to diskless work stations and the increasing use of computer-aided design and manufacturing—applications that involve large and rapid file transfers—network performance capabilities are being pushed to the limit. In graphics-intensive applications, network bandwidth requirements in the hundreds of megabits are becoming necessary. Networks operating at 10 Mb/s will soon become inadequate for many applications they now serve. High-speed networks such as Hubnet will stimulate the evolution of LANs, broaden their application base, and give them a new dimension. ☐

Harvey Ikeman is manager, design and development, at Canstar Communications, Scarborough, Ont., Canada. E. Stewart Lee and Peter I.P. Boulton are professors with the Computer Systems Research Institute at the University of Toronto, Toronto, Ont., Canada.

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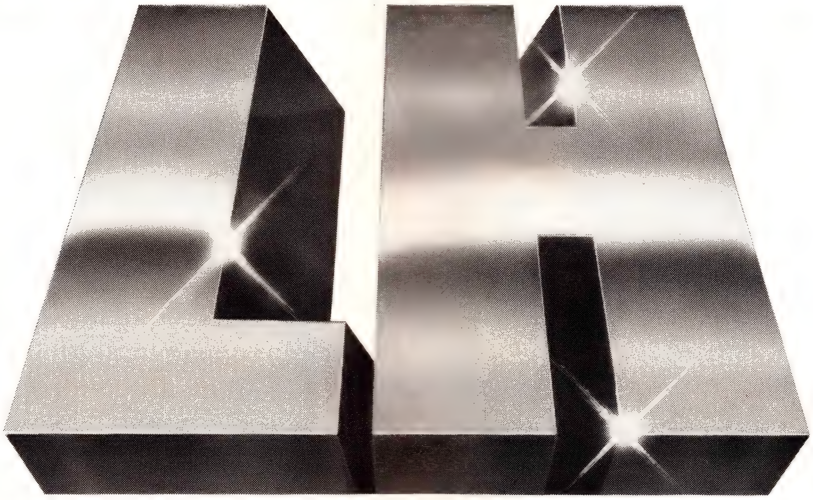

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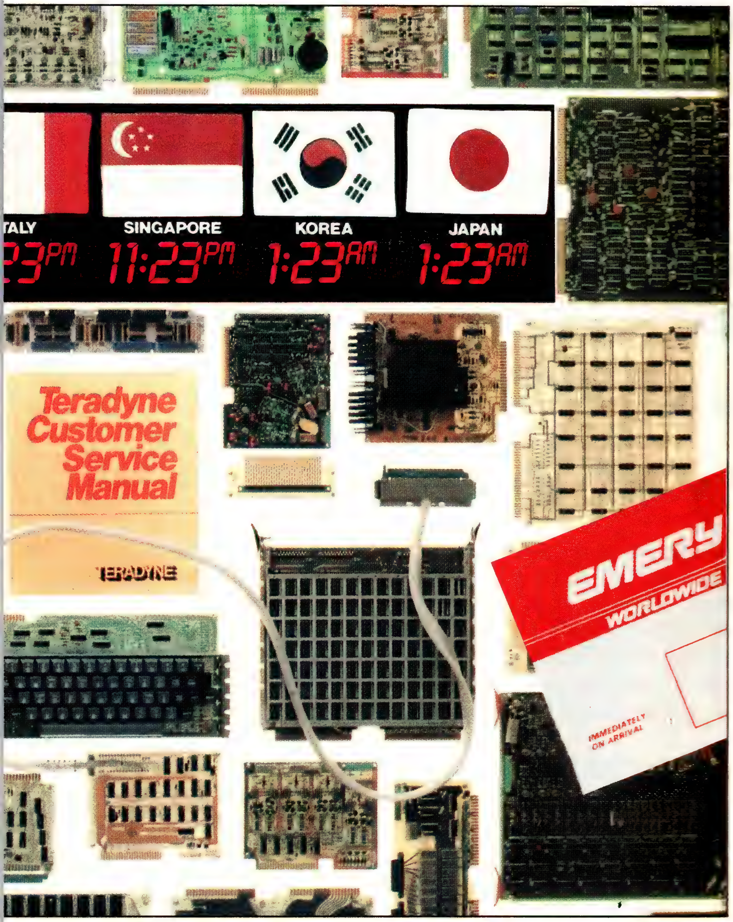

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"I got responsibility right away," says Ronald Jackson, an electronic engineer. "As I showed ability, my responsibility grew. Today, I'm a project engineer." Through NUSC's liberal education policy, Ron has earned a master's since he joined Newport and is working toward a Ph.D.

Because the Center helps its scientists become expert in other fields, electronic engineer Donna Doane is concentrating on computer software. "I'm doing things people never have done before," Donna says. "I design the project, and I see it to the end—to the final product." Monica Sachs is learning something new each day. "I'm working on weapons systems engineering, a broad subject that allows you to get into several different kinds of engineering. I use my electronic engineering background to understand the other disciplines." And Peter Santiago applies his computer background to quality assurance. "I look for self-gratification in the job, and I get that at NUSC."

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DIGITAL FILTER HANDLES 24-BIT DATA

N-MOS digital filter chip boasting 48 bits of internal accumulation makes possible implementation of large-vocabulary speech-recognition software ☐ *by Steve Zollo*

Boasting a signal resolution about 50% greater than currently available integrated circuits, the KSC 2408 digital filter chip allows data and coefficients each to be represented in 24 bits. Filtering takes place with 48 bits of internal accumulation. Thanks to the n-MOS chip's bit serial arithmetic and internal multiplexing, filtering, along with such built-in features as input rectification and output decimation all can occur in a 24-pin dual in-line package.

The chip features eight programmable second-order filters with two poles and two zeros each. The eight filters either can be configured to work independently or they can be cascaded to form higher-order filters—fourth, eighth, or sixteenth order.

The 2408 can filter signals throughout the audible range and beyond, up to a sampling rate of 125 kHz. According to Michael Tomasic, chief operating officer of Kurzweil Applied Intelligence, the filter was designed to the implement large-vocabulary speech-recognition software that the company is now perfecting. The filter grows out of artificial intelligence work Kurzweil is doing on a voice-activated typewriter and related subsystems and components.

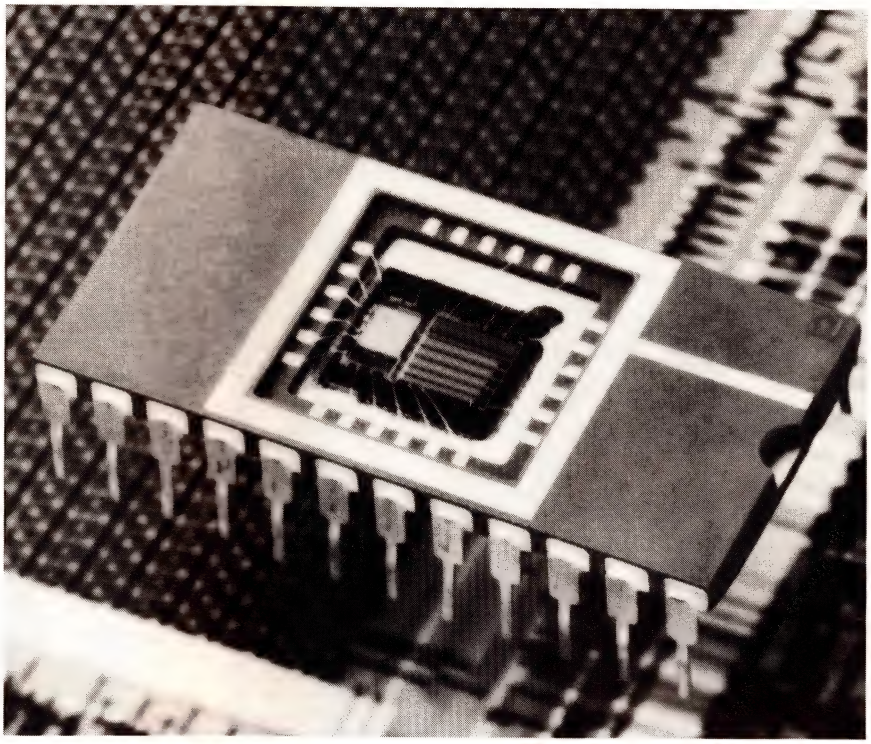
In addition to speech recognition, the filter chip is expected to have applications in digital signal processing such as telecommunications, audio recording, seismic testing, vibration testing of structures, noise control, acoustic research, sonar, and also in the technical and medical instrumentation fields.

According to the company, the general-purpose signal-processing chips commonly used as filters, such as the TMS320, are less accurate than the 2408 and must be laboriously programmed for filtering in the system software.

Besides providing designers with improved filter precision, the 2408 is programmable for a wide variety of filtering applications. The chip's high resolution is particularly important in applications where quantization noise and filter stability are critical, the company says.

To form finite-impulse and infinite-impulse response filters with the 2408, an appropriate configuration chain is loaded onto each pin. Because this chip uses only a single input/output pin, there is more space for on-chip functions such as built-in synchrony, error detection, and rectification.

The chip's architecture was planned to allow system engineers maximum flexibility in designing filters. It is suited to those applications where large number of filters are used, such as in arrays of filter banks. It is also possible to multiplex the eight internal filter components



with each other. The 2408 has on- and cross-chip multiplexing capabilities with the maximum number of devices multiplexed being determined only by the decimation factor. In the case of the 2408, the decimation factor can be set anywhere from 1 to 255. By selecting the proper coefficient, a highly accurate bandpass, lowpass, or high-pass filter can be formed with the 2408.

Priced at $57 each in lots of 1,000, the 2408 is available from Kurzweil's distributor, Diplomat Electronics Corp., of Melville, N.Y. The chip comes in two versions—as a 6-MHz part that consumes 0.60 W and as a 4-MHz part that consumes 0.50 W.

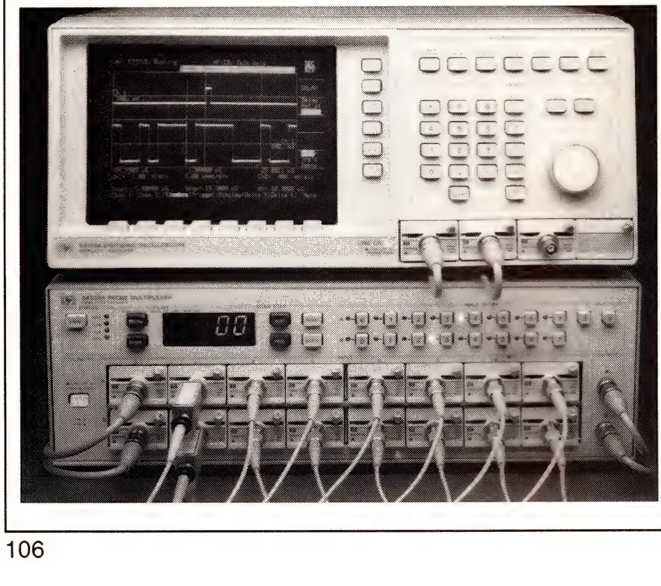
Kurzweil Applied Intelligence, 411 Waverly Oaks Rd., Waltham, Mass. 02154. Phone (617) 893-5151
[Circle reader service number 338]

1-GHz digitizing scope tests high-speed logic systems

With a 1-GHz bandwidth and a time-base accuracy of 100 ps, the HP 54100A/D programmable digitizing oscilloscope was developed as a general-purpose tool for digital designers working with TTL, emitter-coupled logic, CMOS, and other high-speed logic families. The instrument provides digital storage, infinite-persistence displays, and pretrigger viewing.

A variety of set-up aids simplifies time-domain measurements for digital design. ECL and TTL presets scale the vertical gain, offset, and trigger levels for the selected logic family. The auto-scale button produces a stable display. Up to 10 front-panel set-ups can be stored in nonvolatile memory, and hard copy can be produced with either a pen plotter or a graphics printer. In addition, the HP 54100A/D is compatible with the HP 9000 series 200 computer, so the user can program complex measurement sequences.

This two-channel oscilloscope comes in two configurations. The HP 54100A provides two vertical channels and one trigger input; the HP 54100D provides two vertical channels and two trigger inputs, in addition to logic-triggering capabilities. Inputs on both configurations have removable pods: the user can choose the one that suits the application.



Three probe pods can be installed in any of the inputs on the front panel of the HP 54100A/D. Three 50-Ω pods are included as standard. Pods of 1-GHz or 1-MΩ may be ordered separately. With the 1-GHz pod, the system bandwidth is 700 MHz.

With a dual eight-to-one probe multiplexer, the user can connect up to 16 probes to a circuit and then select two at a time, with no need to disturb the test points.

The price of the HP 54100A is $17,600. Delivery takes four weeks. The price of the HP 54100D is $19,300, with an eight-week delivery time.

The probe multiplexer (HP 54300A) sells for $6,800, and delivery time is eight weeks. The 1-GHz 54001A probe sells for $750, additional 50-Ω 54002A probes sell for $130 each, and the 1-MΩ 54003A sells for $550. Delivery time for all probes is six weeks from receipt of order.

Hewlett-Packard Co., Inquiries Manager, 1820 Embarcadero Rd., Palo Alto, Calif. 94303 [Circle 340]

Bus interface for Macintosh supports advanced features

Complete IEEE-488 capability is provided by the Mac488, including controller, talker, and listener functions. The Mac488 executes the same commands and protocols as the Hewlett-Packard Co. model 85 computer and supports such advanced features as pass control, receive control, secondary addressing, parallel poll, and serial poll.

With the Mac488, the Macintosh personal computer can communicate as a peripheral with other 488 bus controllers. The peripheral command changes the Mac488 to a noncontroller peripheral from the system controller power-on state.

The serial port on the Macintosh sends commands and receives data from the Mac488. Programs supporting the serial port can control the interface. Communication is asynchronous, and the default baud rate is 9,600 kb/s; valid rates are from 110 to 19,200 bauds.

The Mac488 is available for $595, including connection cable. Delivery will be made in two weeks after receipt of order.

IO Tech Inc., P.O. Box 21204, Cleveland, Ohio 44121.
Phone (216) 321-0609 [Circle 341]

Scanner converts drawings and text to electronic files

A graphic digitizer and text-input system, the Personal Scanner, has been developed for use with personal computers. It provides both optical character recognition and image processing in a single unit, to convert text or graphics from hard copy.

Hardware consists of a desktop scanner, a cable, and a half-size interface card for the IBM Corp. PC and PC/XT personal computers. The manufacturer plans to modify the system so that it will work with Apple and other Motorola-68000-based computers as well.

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Circle 107 on reader service card

The Personal Scanner is being marketed for office use. The manufacturer believes that its small size and quiet operation along with its dependability (self-contained light source, one moving part) and low price will make the system attractive to users now using several single-function machines to perform the Personal Scanner's page-reading and image-processing functions.

The price of a single unit is $2,487. Delivery is scheduled for November.

Electronic Information Technology Inc., 373 Rte. 46 W., Fairfield, N.J. 07006.
Phone (201) 227-1447 [Circle 344]

One reader does many jobs with dual-interface port

With its dual-interface capability, the AlphaWord series 80 model D page reader can enter data into two host machines (computers, peripherals) that may each have a different interface as well as require different codes and formats.

A dual-output port and plug-in module provide the necessary electronics to route data with the correct interface, code, and format programs. When another interface is required, the user changes modules.

A second interface is not needed, however, for input to two identical hosts; a commercially available A-B switch may be used.

The price of the AlphaWord series 80 model D is $14,990. It is available 30 days after receipt of order.

Compuscan Inc., 81 Two Bridges Rd., Bldg. 2, Fairfield, N.J. 07006. Phone (800) 631-0951 or (201) 575-0500 [Circle 345]

Local-use modem has 4-to-17-mile range

A modem for local use, the LDS-309A has such features as auto-equalization for easier installation and both synchronous and asynchronous data-handling capabilities. It has been designed for high-speed data transfer within a building, across the street or campus, or within a 4-to-17-mile range.

The LDS-309A operates at data rates of 2,400, 4,800, 9,600, and 19,200 b/s in either mode. It operates full duplex over 4-wire nonloaded telephone cable or half duplex over 2-wire nonloaded telephone cable. Available now, the LDS-309A is priced at $495.

Gandalf Data Inc., 1019 S. Noel, Wheeling, Ill. 60090.
Phone (312) 541-6060 [Circle 387]

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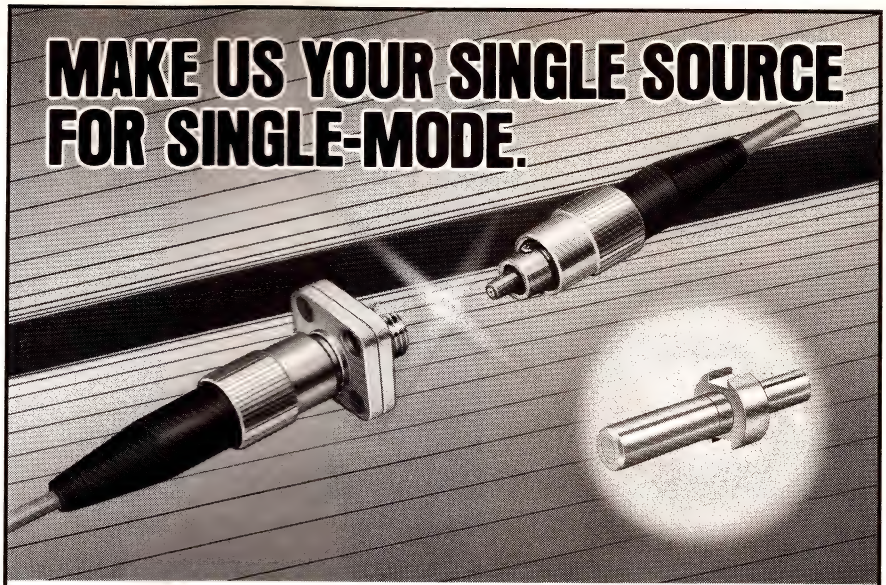

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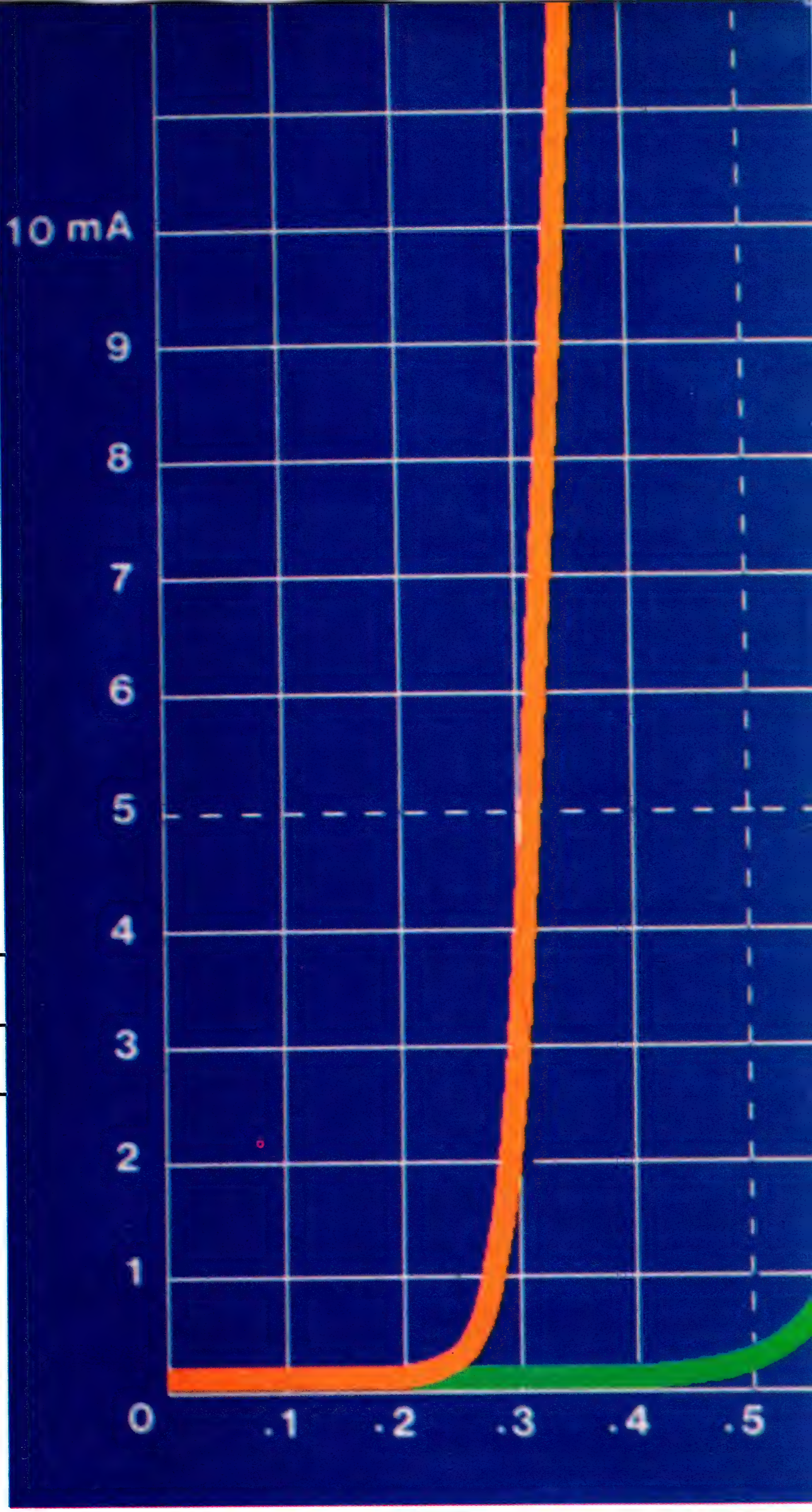

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A NEW HORIZON

SMALL SIGNAL SCHOTTKY DIODES

In the Schottky diode the potential barrier results from a metal to silicon contact.

The main features of this device are:

- *Low turn-on voltage.*
- *Sub-nanosecond switching time.*
- *Low reverse capacitance.*

These high performance Schottky diodes afford considerable improvements over conventional P/N junction diodes. This is a fact that has long been recognized, however up until now prices have been the limiting factor, restricting applications to professional equipments.

High volume production of devices encapsulated in the rugged double stud D035 and D041 glass packages allows Thomson Semiconductors to offer a low-cost, high reliability machine insertable product suitable for volume small signal and low- cost applications.

Most of the devices are also available in T0236 plastic micropackage well suited for surface mounting purposes.

Application areas cover telecommunications, computers, automotive and consumer oriented fields, market areas that Thomson Semiconductors are at the forefront of technology.

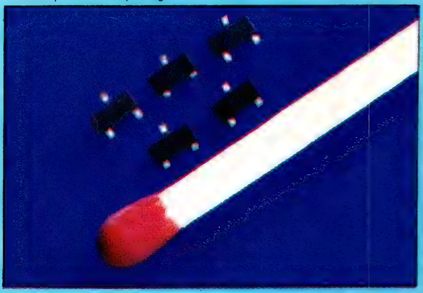
RF AND ULTRA FAST SWITCHING FAMILY

P/N	CASE	V_{RM} (V)	V_F @ 1 mA (V max.)	I_F @ 1 V (mA min.)	C @ 0 V (pF max.)
BAT 17 (1)	T0236	4	0.6 *	—	1.0
BAT 19 (2)	D035	10	0.4	20	1.2
1N6263	D035	60	0.41	15	2.2
BAR 18 (1)	T0236	70	0.41	15	2.0
BAR 10 (3)	D035	20	0.41	35	1.2

(1) Also available as a double diode. (2) Similar to 5082-2900
*(3) Similar to 5082-2810 * @ 10 mA.*

Effective minority carrier lifetime is 100 ps max for all devices.

TO 236 plastic micropackage



Typically the devices will suit applications requiring:

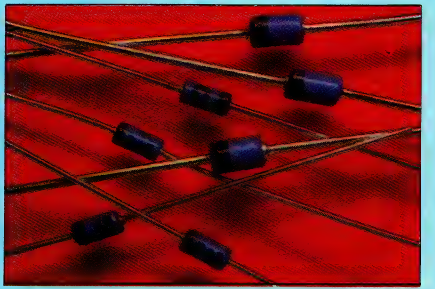
- *Transistors and digital circuit speed-up.*
- *Wave-form sampling.*
- *Wave-form clamping and clipping.*
- *UHF mixing and detection.*

GENERAL PURPOSE FAMILY

TYPE NO.	CASE	V_{RM} (V)	V_F @ 10 mA (V max.)	I_F @ 1 V (mA min.)
BAT42	D035	30	0.4	100
BAR42 (1)	T0236	30	0.4	100
BAT48	D035	40	0.4	500***
BAT41	D035	100	0.45*	200
BAT46	D035	100	0.45	250
BYV10 (2)	D041	20/40	0.55**	—

(1) Also available as a double diode. (2) Similar to 1N 5817 series
** @ 1 mA. ** @ 1 A. *** @ 0.9 V.*

DO 35 and DO 41 glass packages



Only Thomson Semiconductors offers a fully comprehensive range, filling the gap between low level RF devices and power Schottky rectifiers, with the potential to satisfy markets currently requiring:

- *Replacement of gold bonded Germanium diodes.*
- *Fast recovery low-power rectifiers.*
- *Reverse polarity and circuit protection.*
- *Situations where low-voltage drop and/or ultra-fast switching is a must.*

PACKAGING

Thomson Semiconductors D035 and D041 glass packaged small signal Schottky diodes are available for automatic insertion either as axial or radial tape/reel packaged. The T0236 surface mounting devices are readily available in bulk or Super-8 mm tape/reel film.

RELIABILITY

A built-in guard-ring acts as a transient suppressor both in the reverse and forward direction protecting the structure against voltage surges, such as electro-static discharges.

Thomson Semiconductors small signal Schottky diodes withstand all IEC 68 standard environmental tests. Reliability insurance life tests (storage, HTRB, operating) are periodically conducted.

Outgoing quality levels are within the range of 100 ppm (average defect rate).

HiRel screened devices are available from Thomson Semiconductors on request.

THOMSON SEMICONDUCTORS Sales Headquarters 45 avenue de l'Europe - 78140 PARIS-VÉLIZY-FRANCE – Tel. (3) 946.97.19.

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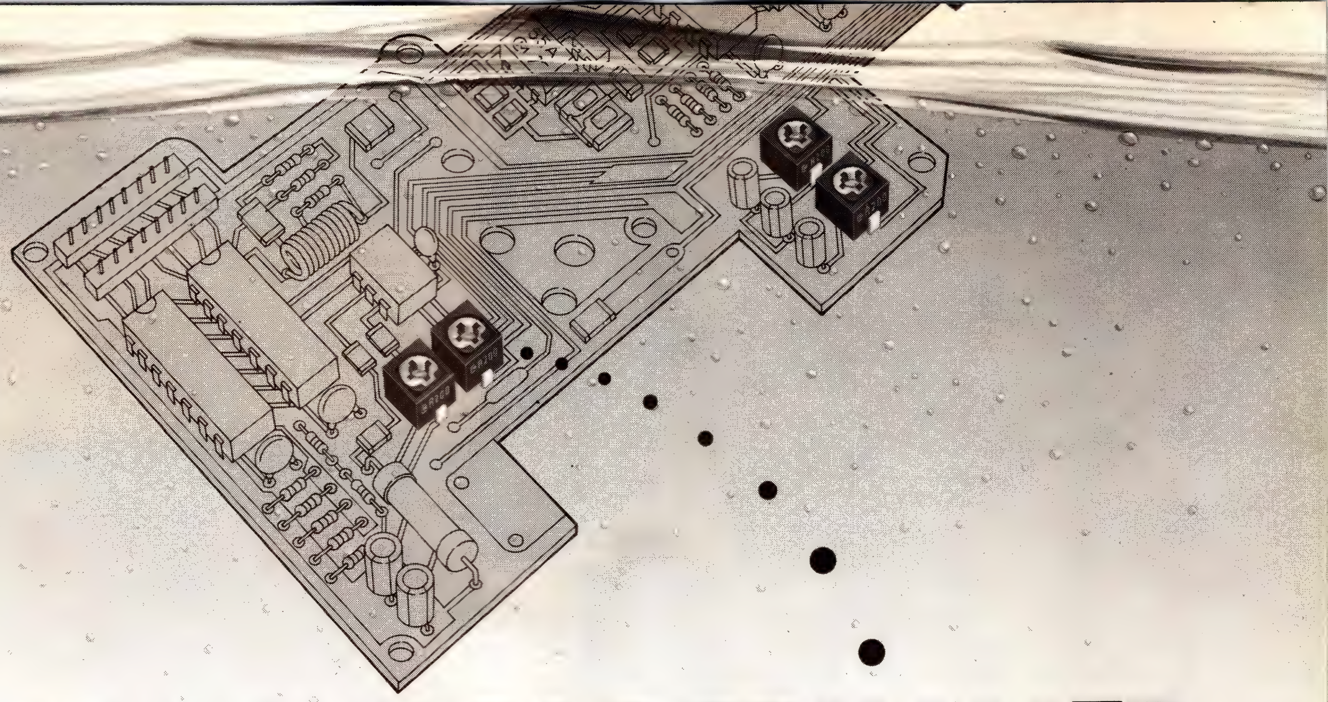
Circle 133 on reader service card

ELECTRONICA MUNICH - HALL 24 BOOTH C 100

BAZAINE
5356

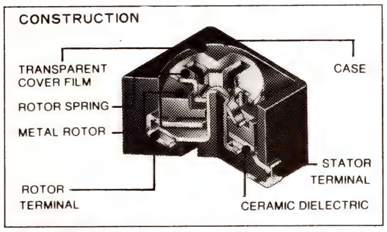


WASHABLE TRIMMER

Murata's ceramic chip trimmer capacitor is washable. Sealed in a thermosetting plastic housing, it is extremely resistant to heat and can be used in the same way as any conventional chip capacitors or resistors.

Use any organic solvent with Murata's TZB04 series chip trimmer capacitors, and dip in flow or reflow soldering or in flux. you'll find TZB04 helping you reduce assembly costs and still offering high quality.

Moreover, the TZB04 unique, cubic configuration allows it to be directly installed on circuit boards, and is ideal for space saving and surface mounting on both sides of a board. Also, four types of terminals are available, and all come either in plastic taping or in magazines to meet all automatic insertion needs.



● Specifications

Single Ceramic Plate Type

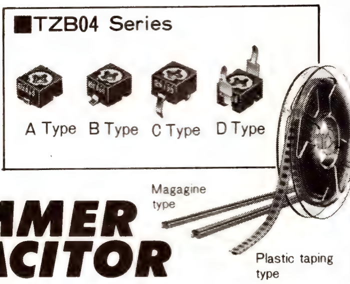
Part Number	Capacitance(pF)		Temp.Coefficient (ppm/℃)	Q Min. (1 MHz, C max.)
	Min.	Max.		
TZB04Z030B☐	1.4	3.0	NPO ±200	300
TZB04Z060B☐	2.0	6.0	NPO ±200	500
TZB04N100B☐	3.0	10.0	N150 ±300	500
TZB04R200B☐	4.5	20.0	N750 ±300	500
TZB04P300B☐	6.5	30.0	N1200±500	300
TZB04P400B☐	8.5	40.0	N1200±500	300

● Rated Voltage···100V D.C. ● Withstand Voltage···220V D.C.
● Insulation Resistance···10^4MΩ min. ● Torque···15～100g-cm

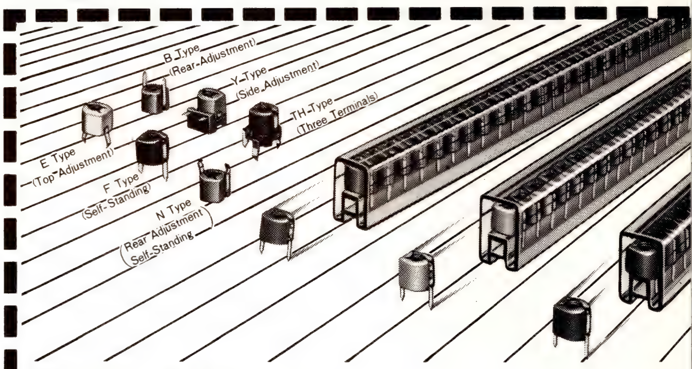
Monolithic Ceramic Plate Type

Part Number	Capacitance(pF)		Temp.Coefficient (ppm/℃)	Q Min. (1 MHz, C max.)
	Min.	Max.		
TZB04Z250B☐	4.0	25.0	NPO ±300	300
TZB04R500B☐	7.0	50.0	N750±300	300

● Reted Voltage···50V D.C. ● Withstand Voltage··· 110V D.C.
● Insulation Resistance···10^4MΩ min. ● Torque···15～100g-cm
★Working Temperature Range −55～+85℃

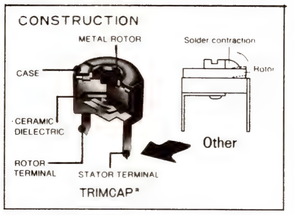


CHIP TRIMMER CAPACITOR



Standard Trimmer.

For reducing assembly cost, use Murata's ceramic trimmer capacitor TRIMCAP® Available in a plastic magazine, it is suitable for a variety of automatic insertion machines, and can be firmly installed to printed circuit boards. Unlike conventional trimmer capacitors with rotors which is distorted by solder, "TRIMCAP®" features linear temperature characteristics because it has no axle and no soldering joint at all. It is available in a wide variety of colored housings according to capacitances and with 6 different types of terminals. Colored plastic housings are extremely resistant to flame, fully satisfying UL Standards. The configuration of "TRIMCAP®" has been patented in many countries of the world and has proven to have cleared numerous safety standards.



● SPECIFICATIONS

A variety of series are available; the single ceramic plate type with 2.3 through 60.0pF and the monolithic ceramic plate type with 50 through 120pF of the capacitances, respectively.

TRIMMER CAPACITOR

TRIMCAP®

For further information, contact:

muRata ERIE

MURATA ERIE NORTH AMERICA, INC. ··· Phone:404-953-1799 Telex:542329
3002 Kingston Court, S.E., Marietta, GA 30067, U.S.A.
MURATA ERIE NORTH AMERICA, INC. CHICAGO OFFICE Phone:312-297-5560 Telex:281009
MURATA ERIE ELEKTRONIK GMBH (WestGermany) Phone:0911-66870 Telex:623763
Kreuzsteinstr. 1A D-8500 Nurnberg 52, West Germany
MURATA ERIE ELECTRONIQUE S.A. (France) ··· Phone:024-6767 Telex:699954
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(Taipei Office) ··· Phone:02-562-4218
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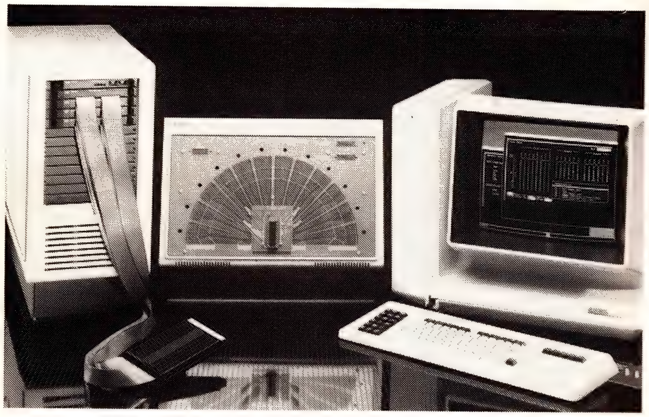
Circle 134 on reader service card



tested. Both systems provide a 20-MHz test rate; a 40-MHz is optional. Overall system timing resolution is 1 ns. Real-time pattern debugging and real-time pattern control are possible with the Logic Master. Control programs can be written in any language.

Availability is 12 weeks after receipt of order. The price of Logic Master I is $29,200; Logic Master II sells for $39,300.

Integrated Measurement Systems Inc., 9525 S.W. Gemini Dr., Beaverton, Ore. 97005. Phone (503) 626-7117 [Circle 343]

Statistical software boosts forecasters' sophistication

A microcomputer version of a statistical forecasting and modeling software package runs on IBM Corp. Personal Computer-compatible equipment with 256-K bytes of memory, DOS 2.0, and two disk drives. An 8087 mathematics coprocessor will shorten the run time.

The program builds univariate and multivariate Box-Jenkins models, including intervention models. The Box-Jenkins model predicts nonstationary time series, with or without seasonal variations generated by periodic external forces, and it has applications in many scientific and business fields.

This software easily interfaces with most planning, investment, accounting, and inventory packages, the manufacturer says. It is available with such automatic features as Autobj (automatic Box-Jenkins).

The one-time licensing fees start at $195; with the Autobj feature included, fees start at $495. A demonstration diskette sells for $5.

Automatic Forecasting Systems Inc., P.O. Box 563, Hatboro, Pa. 19040. Phone (215) 675-0652 [Circle 347]

Software line is developed for automated-factory use

Modules to control mechanical parts design, analysis, and manufacturing that are integrated with advanced-information-management software from the same company have been released. The Cimplex product set runs on the VM/CMS operating system and is compatible with IBM Corp. software such as Cadam and Copics. The manufacturer is a systems integrator of the IBM 5080, and Cimplex is designed to take advantage of this series' graphics-display technology.

The three Cimplex modules offer such capabilities as generators to create symmetric or asymmetric forms, contour display of deformation in stress analysis, and interactive two- to five-axis capability for multipath pocket milling.

An information-management module, Factory Automation Information Management, includes active monitoring and automatic change control and change notification on the level necessary for computer-integrated manufacturing. Data-modeling techniques include Codasyl conventions to coordinate activity centers.

The complete Factory Automation Information Management module with license fee is $100,000. It is available now. For Cimplex, the minimum annual license fee for an individual module is $40,000, and each module is offered separately. They will be available during the second quarter of 1985.

Automation Technology Products, 1671 Dell Ave., Campbell, Calif. 95008. Phone (408) 370-4000 [Circle 346]

Unit powers computer memory for over 1 hour

A 5-V dc backup power supply, the MUP-0503, features line isolation and an internal charger for its (optional) nickel-cadmium batteries and can completely replace a standard power supply, the manufacturer says. The uninterruptible-power-supply capability is incorporated within the unit.

If there is line failure, the MUP-0503 can power a microprocessor logic and memory system for over 1 hour, with a 10-h recharge time. Input voltage is 100 to 132 V ac, 47 to 63 Hz. Output voltage is 5 V dc at 3 A.

The MUP-0503 is available from stock, either with an enclosure or on an open printed-circuit board. In original-equipment manufacturer quantities, the price is $120, without batteries.

Instrumentation and Control Systems Inc., 520 Interstate Rd., Addison, Ill. 60101. Phone (312) 543-6200 [Circle 355]

Standard dc-dc converter line meets military specifications

To provide an alternative to custom military-design capability, standard triservice qualified dc-dc converters are announced in three power-output ratings.

The 4000 series single-output converter comes with ratings of 75, 150, and 300 W. The 5000 series dual-output converter is rated at 180 W, and the 6000 series triple-output converter at 175 W. Within the power ratings, various voltage-current combinations are available.

Mean time between failures is 71,400 h for the 4000 series and 72,000 h for both the 5000 and 6000 series, per MIL-HDBK-217C for a ground-fixed environment at an 85°C base-plate temperature.

All converters incorporate power MOS FETs operating at 100 kHz. The single-ended forward converter topology results in fewer power components, the manufac-

There's quality...

...and there's protected quality.

When you really need top quality and reliability down to assembly line level, even the best AQL's and PPM's are not enough.
Quality has to be protected.
Protection begins with design, continues in fabrication and is guaranteed in shipping.
SGS MOS products, such as memories, high speed CMOS, microprocessors, etc., are designed with full protection against electrostatic discharge.
But that's just the starting point.
All SGS MOS devices are shipped in antistatic DIL chip carriers which are in turn vacuum sealed into conductive shielding bags.
This gives 100% protection against electrical fields, humidity or oxidizing agents.
Super quality deserves super protection down to assembly line level. You get it with SGS MOS products.

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SGS® Technology and Service

SGS-ATES Componenti Elettronici SpA
Via C. Olivetti, 2 - 20041 Agrate Br. (Italy). Tel. 039-65551

turer says, which increases the unit's reliability.

Features include soft-start circuitry, low-line lockout, output foldback current limiting, and shutdown-type overvoltage protection.

In quantities of 100, the prices of the 6000 series range from $2,196 to $3,720. Delivery takes 150 days.

Rantec Power/Systems, 9401 Oso Ave., Chatsworth, Calif. 91311. Phone (818) 885-8223 [Circle 356]

Photoelectric controls ignore randomly reflected light

Two photoelectric retroreflective controls respond only to the polarized light received from corner-cube reflectors, ignoring random reflections from shiny surfaces in their environment. The MLS8C-P has a 15-ft range and operates on ac power; it is self-contained. The industrial-limit switch-housed FE-LP is available in dc or two-wire ac versions and has an 8-ft range.

The dc units offer a range of voltage inputs from 9 to 30 V dc and are available in either current-sinking or current-sourcing versions. The maximum continuous load current is 200 mA, and the control can perform 1,950 operations/min.

The two-wire ac units run on a line voltage of 50 to 60 Hz (93 to 132 V ac). Leakage current is less than 2 mA, and operation rate is 1,500/min. Both versions offer National Electric Manufacturers Association 1, 3, 4, 12, and 13 sealing. They will operate in temperatures from –40°C to +55°C.

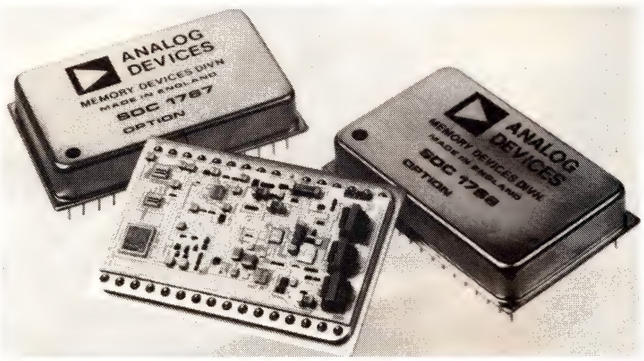
The ML8SC-P sells for $155. The FE-LP lists for $141 (dc) and $145 (ac). Shipping is from stock.

Micro Switch, a Honeywell Division, 11 W. Spring St., Freeport, Ill. 61032. Phone (815) 235-6600 [Circle 353]

Converter offers continuous tracking at 36 revolutions/s

A hybrid synchro/resolver-to-digital converter has a tracking rate that the manufacturer claims is 50% faster than similar converters with internal transformer isolation. The 12-bit SDC/RDC1767 tracks at up to 36 revolutions per second, while the 14-bit model tracks at up to 18 rps.

The converters are based on a type II servo loop, which permits them to follow a rotating shaft without velocity lag. Continuous tracking, even during data transfer, prevents stale data problems.



Signal and reference frequency ranges from 400 Hz to 2.6 kHz, and a dc error output can be used as a testpoint for built-in test-equipment. Both models produce parallel outputs, with a load-driving capability of 6 TTL loads; the manufacturer claims 2 TTL loads for competitive devices.

Maximum error is guaranteed at ±8.5 and ±5.3 arc-min for the 1767 and 1768, respectively. The converters are packaged in a 32-pin metal dual in-line package and are available with either standard or military screening.

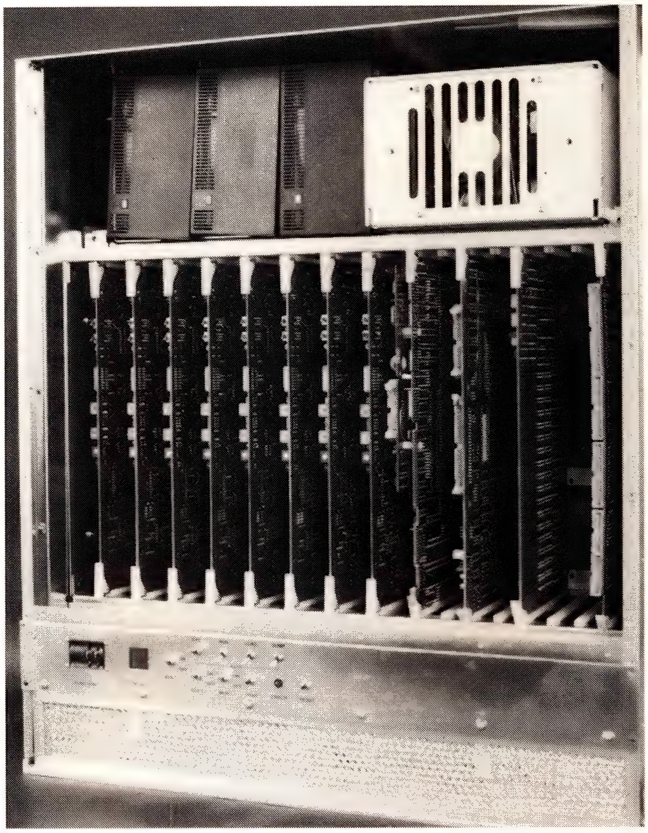
Delivery takes up to eight weeks. In quantities of 10 to 24 pieces, the 1767 sells for $471 and the 1768 sells for $503.

Analog Devices Inc., 2 Technology Way, Norwood, Mass. 02062. Phone (617) 329-4700 [Circle 348]

Voice store/forward system can support 100 to 500 users

Designed exclusively for original-equipment manufacturers and distributors, a small-capacity system for voice storage and forwarding is the smallest member of the VMX line. The four-port model VMX IV supports from 100 to 500 users and can serve as many as 1,000 users when extra ports and storage are added.

The system can also be linked through Voicenet, the manufacturer's proprietary network, to other voice message exchanges worldwide. The VMX IV is small enough to be incorporated into an OEM's equipment rack as an integral component and includes the standard features



found in the model VMX III. Optional features such as Voicenet, Message Desk, and Call Answering are also offered.

Scheduled to become available in the fourth quarter, the basic model VMX IV sells for $50,000.

VMX Inc., 1241 Columbia Dr., Richardson, Texas 75081. Phone (214) 699-1461 [Circle 357]

Transmitter combiners suit cellular radio systems

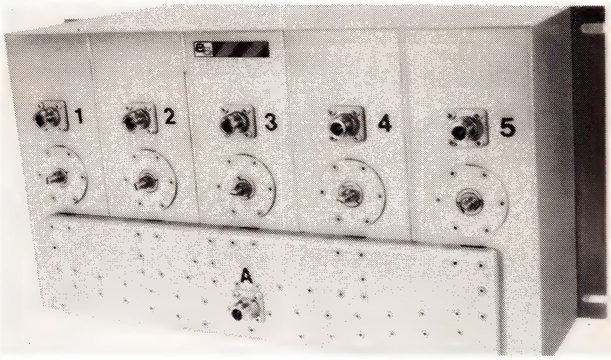
Based on waveguide technology, a line of transmitter combiners intended for mobile radio systems requires 30% to 70% less rack space than models using coaxial-resonator techniques, the manufacturer says. The equipment consists of a series of separate shared-wall waveguide sections, with outputs combined by strip-transmission lines.

Laboratory and field tests indicate a high level of performance and reliability, the firm says. For example, at 630-kHz separation in cellular systems, the waveguide combiners provide greater isolation for a given insertion loss. Using strip-transmission lines rather than cavity intercabling virtually eliminates a major source of intermittent and degraded performance in conventional designs.

The first models are designed for trunked, conventional, and cellular operation in the 850-to-960-MHz range. The units fit 19- or 23/24-in. racks and are available in a variety of configurations from 4 to 16 channels, which are field expandable for more channels.

Available in four weeks or less, the line's prices begin at $1,900.

The Antenna Specialists Co., Marketing Dept., 12435 Euclid Ave., Cleveland, Ohio 44106. Phone (216) 791-7878 [Circle 358]



Unit encodes and decodes data at a 9,600 b/s rate

An encryptor/decryptor designed to safeguard sensitive, unclassified government data, the Datacryptor II Model 1027 implements the U.S. National Bureau of Standards' Data Encryption Standard algorithm. It operates with protocol transparency at data rates up to 9,600 b/s, synchronously or asynchronously, in full- or half-duplex modes and on leased or dial-up lines.

For each data communication link encrypted, the Model 1027 works in conjunction with an accessory Key Writer to enter cryptographic key values in compliance with FED-STD 1027.

The Datacryptor Model 1027, available now, is priced at $2,800 for single units.

Racal-Milgo, 8600 NW 41st St., Miami, Fla. 33166. Phone (305) 592-8600 [Circle 385]

Controllers enhance system flexibility

The 560 and 565 programmable controllers are said to enhance system flexibility, reliability, and cost-effectiveness. The 560 is designed to handle discrete operations for applications such as machine control, material handling, and conveyors. The 565, with a parallel special-function central-processing-unit card added to a 560 chassis, is designed for discrete, batch, continuous, and data-manipulation applications.

Based on multiple 68000s, each model is contained in a standard 19-in. card rack. The unit's core is its discrete CPU card, with 48-K words of user-configurable battery-backed time-of-day clock and two peripheral ports. A modular remote input/output system can be increased to 8,192 I/O points of field and be located up to 15,000 ft from the controller.

Users can expand memory in the field from a 48-K word minimum up to 256-K words for a full-up system. Available in late 1984, both models come in two basic configurations.

Texas Instruments Inc., Dept. TI ISD NR-1, P.O. Box 809064, Dallas, Texas 75380. [Circle 367]

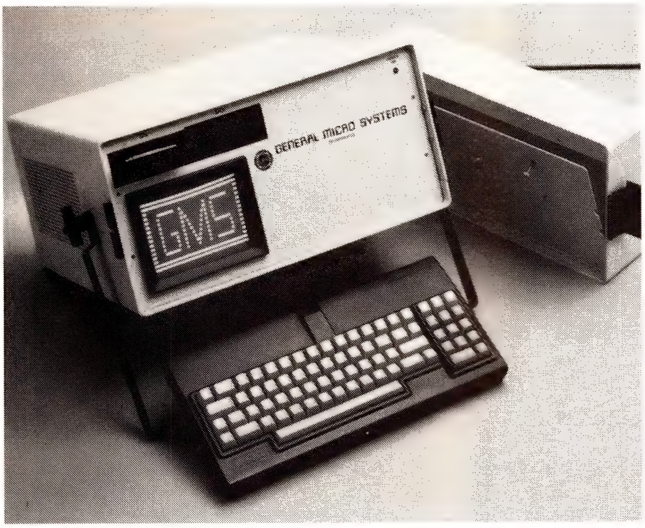
Industrial controller works with analog, digital I/O ports

The GMS system 68K is a programmable industrial controller said to work with hundreds of analog or digital input and output ports and can also control printers, terminals, modems, and relays. It is also intended for use in process control, test equipment, or data-gathering applications.

Self-contained in a single housing, the system is based on the 68008 high-speed microprocessor. It includes a cathode-ray tube display, rugged keyboard, and disk drives. Input and output ports run through a rear connector panel. The controller's 16-bit speed enables it to provide high-speed data handling and math routines, automatic test equipment, and process control applications.

The system accepts and controls up to 256 analog channels and interfaces with IEEE-488 instruments. It accepts digital I/O channels in multiples of 80 lines and controls up to 16 channels of optically isolated ac/dc I/O analog input levels from several millivolts to hundreds of volts. Its 3½-in. industrial drives are available as floppy or Winchester disks or streaming tape.

Available now, a controller with analog and digital input ports, keyboard, monitor, and disk drives is priced



from $3,500 to $4,000 depending on options.

General Micro Systems Inc., 1320 Chaffey Ct., Ontario, Calif., 91762. Phone (714) 621-7532 [Circle 368]

Machine inserts up to 4,000 DIPs, 3,600 sockets/hr

The 6796 Uni-Module inserts a variety of dual in-line packages and sockets into printed-circuit boards. The machine uses a single insertion head to accept components from a shuttle that travels horizontally to input magazines.

The shuttle retrieves a component from 1 of 72 magazine stations and delivers it to the insertion-head transfer station, where the component leads are combed and straightened prior to insertion. Meanwhile, an X-Y positioning system finds the programmed insertion location on the pc board.

A rotary table provides indexing from 0° to 360° in 90° increments to allow the insertion of DIPs in both the X and Y orientation with one pass of the board. The table indexing is under pattern-program control and requires less than 1 s to execute each 90° index.

The basic Uni-Module inserts 0.300-in. packages with 6 to 20 leads, while optional tooling permits the insertion of DIPs with up to 24 leads. The insertion head may also be tooled to accept a combination of DIP sockets and modules.

At a basic price of about $65,000, the Uni-Module is available in about four months.

Universal Instruments Corp., P.O. Box 825, Binghamton, N.Y. 13902. Phone (607) 775-1747 [Circle 363]

Soldering system is suitable for midline production

A soldering machine called the Mini-Wave is intended for production of printed-circuit boards in moderate quantities, as well as laboratory testing and special productions applications.

The machine's features include a foam fluxer, six 500-W preheater elements, a 220-lb-capacity solder pot with variable solder-wave height adjustment, and a control panel. The system requires only 66 by 21 in. of floor space. Optional elevators, traffic controllers, belt conveyors, and blocking devices are available for continuous in-line production.

Scheduled to be available in about two months, the system's base price is $7,000.

Universal Instruments Corp., P.O. Box 825, Binghamton, N.Y. 13902. Phone (607) 775-1747 [Circle 364]

Surface-mounted placer unit handles a variety of parts

A surface-mounted component placement system, the MCT 6000, is a sequential model that populates Type I, Type II, and Type III surface-mount-technology circuits. The system combines a distributed processor-based controller with a closed-loop servo-drive system and automatic board and component handling.

Capable of handling a placement area of up to 12 by 18 in., the MCT 6000 accommodates a variety of feeder and component types. It handles components from 0.040 by 0.040 in. to 1.2 by 1.2 in. with one placement head. Presentation media include carrier tape and linear vibratory magazines, as well as several integrated-circuit feeders.

The unit features a production rate of 6,000 placements/h with a placement accuracy to within 0.002 in. and rotation accuracy of 10 min. of arc. The system uses its menu-driven program in order to control all placement parameters.

Expected to be available in the fourth quarter, the system will sell for between $150,000 and $180,000. International prices may vary.

MicroComponent Technology Inc., 599 Cardigan Rd., P.O. Box 43013, St. Paul, Minn. 55164. Phone (612) 482-5100 [Circle 365]

32-bit multiuser line employs 68008, runs Regulus

COMPUTERS

Unix-based desktop computers with disk capacities up to 150 megabytes are intended for value-added resellers, systems integrators, equipment manufacturers, and end-users. Each model in the VAR/68K line incorporates 32-bit 68008 processors and Unix-compatible Regulus operating systems.

Due to the memory-sharing and disk-swapping capabilities of Regulus, the VAR/68K line handles multiple users efficiently. Applications and data are automatically swapped between memory and disk, and disk files are buffered in cache memory in order to accelerate input/output operations.

The computers employ automatic task-switching hardware that minimizes the time necessary to switch between supervisor- and user-operating modes. External direct-memory-access transfers are executed at rates of up to 2 megabytes/s and programmed I/O operations up to 1.6 megabytes/s.

The basic configuration consists of the computer, terminal with keyboard, 1 megabyte of floppy-disk memory, 5 megabytes of hard-disk storage, eight RS-232-C ports, a Centronics-type parallel port, and Regulus operating system. Prices range from $7,900 to $25,000, depending on the configuration; prices are up to 40% lower in multiple quantities. Deliveries take up to four weeks.

Smoke Signal, 31336 Via Colinas, Westlake Village, Calif. 91362. Phone (818) 889-9340 [Circle 360]

Computer's laser disk holds analog, digital data

The model LPC-1000 incorporates laser video-disk technology, making it suitable for applications such as interactive training, data base, electronic publishing, and archival storage. With the system's proprietary digital data encoding scheme, the user can compress text, programs, and audio data and store it on the system's 12-in. laser video disk, which carries all information for a given application.

Both analog and digital data can be stored on the video disk, including motion sequences up to one hour

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Circle 119 on reader service card

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in length, over 100,000 still images, over 100 hours of audio information, 1 million pages of alphanumeric text, and over 1 gigabyte of computer digital data. The disks are difficult to copy, rugged, and permit long storage life.

The model LPC-1000 includes a graphics generator with resolutions of 640 by 400 or 320 by 400 pixels. The graphics produced can be overlaid onto the video disk picture.

In the microcomputer mode, the model LPC-1000 serves as a general-purpose 8086-based system with the CP/M-86 operating system. In the video playback mode, it uses a red-green-blue monitor and plays video disks in linear mode. Any commercially-available laser disk can be played. Another mode allows interactive training, simulation, or other applications that require real-time video and audio feedback.

The model LPC-1000 sells for $9,750; production quantities will be available for delivery sometime in early 1985.

Tomax Inc., 5800 Andover Ave., T.M.R. Quebec, Canada H4T 1H4. Phone (514) 735-6541 [Circle 361]

Two dot-matrix printers are versatile, low-end devices

Targeting the growing under-$1,000 market for matrix printers, the Personal Printer I and Personal Printer II come in two carriage widths and offer a number of features attractive to microcomputer users.

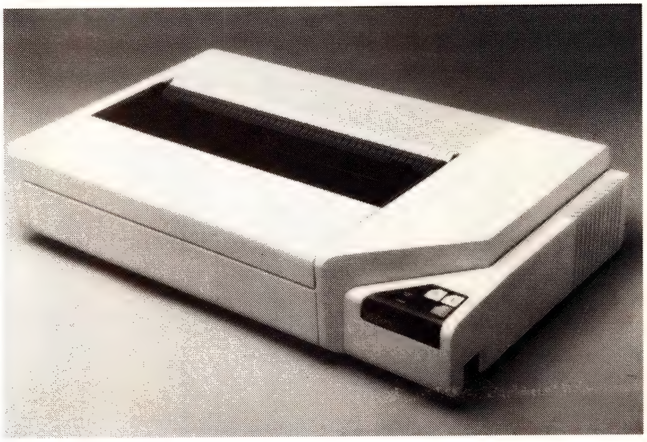
The Personal Printer I has a 10-in. carriage and prints up to 80 columns at 10 pitch or 136 columns at 17 pitch. The Personal Printer II has a 17-in. carriage and prints up to 156 columns at 10 pitch or 256 columns at 17 pitch.

Both models feature friction and pin feed, bidirectional printing, a 2-K-byte buffer, and close form tear-off to avoid wasted paper. The Centronics parallel interface is standard, with the RS-232 interface available as an option. The noise level is low, under 60 dBA.

Retail prices are $695 for the Personal Printer I and $895 for the Personal Printer II. They are available through the firm's sales distributors.

Datasouth Computer Corp., 4216 Stuart Andrew Blvd., Charlotte, N.C. 28210. Phone (704) 523-8500 [Circle 350]

Matrix printer relies on advanced print head



The model OT-700 matrix printer, with a print head that operates at speeds of up to 700 characters per second, offers micro- and minicomputer users performance equal to matrix line printers, the manufacturer says. Intended to meet high-volume output needs of data-processing environments, the OT-700 has no duty-cycle limitations.

The OT-700 also creates letter-quality printing at 350 characters/s and comes with a variety of character sets. The unit offers a carriage width of 136 columns. Paper feed is from the front or bottom of the case.

Dot-addressable graphics printing is available in two operating modes: 50 by 69 dots/in. for high-speed output or 100 by 69 dots/in. for high-resolution copies.

Deliveries will start in November. The price of the OT-700 is $1,495, and discounts are available for distributors and original-equipment manufacturers.

Output Technology Corp., 606 110th St. N.E., Suite 205, Bellevue, Wash. 98004. Phone (206) 453-9794 [Circle 351]

Laser printer works with IBM Personal Computers

A letter-quality text and graphics printer, the Laser 8 is designed for use with a variety of personal computers, the manufacturer says. The Laser 8 responds to high-level commands, and prints both text and graphics at a resolution of 300 dots/in. and at a speed of up to eight pages/min. Laser xerography forms the characters on the paper.

An internal microprocessor performs printing operations without tying up the host computer, which can be any one of several manufacturers' models. The Laser 8 can also attach to the Concept 100, a system of hardware and software that integrates text and graphics with a board that fits into the IBM PC/XT and PC/AT.

The printer is compatible with IBM Corp.'s Personal Computers, including the PC/AT, and with the Virtual Device Interface (VDI), the industry graphics standard recently adopted by IBM.

In addition to operating in VDI graphics, the printer emulates the Tektronix 4014 and the Diablo 630 daisywheel printers, implements the ANSI X3.64 formal standard, and uses a bit-image mode that provides a direct path to the bit-map random-access memory for imaging applications.

Shipments of the Laser 8 will begin in November. The price of the printer is $7,995.

Concept Technologies Inc., P.O. Box 5277, Portland, Ore. 97208. Phone (503) 684-3314 [Circle 352]

Microcomputer package aids rf, microwave IC designers

A software package that runs on IBM Personal Computers and PC-compatibles can be used by engineers in designing, analyzing, and optimizing radio-frequency and microwave circuits, as well as in preparing drawings,. documentation, and camera-ready artwork. Touchstone, the circuit analysis and optimization program, lets engineers construct circuits from a catalog containing over 80 elements and take over 190 measurements, including noise figures, stability and source mapping circles, differential phase shift, group delay, gain, and loss.

The artwork program, MiCAD, automatically processes and displays a Touchstone circuit on a graphics monitor. Any change made to the circuit is shown in real time. MiCAD supports many plotters and artwork generators, including the HP 7580/85 drafting plotter, the Aristomat 100, and the Wild Heerbrugg Aviotab TA2.

Touchstone comes with 512-K bytes of random-access memory and an 8087 math coprocessor. It is available immediately for a price of $7,500. MiCAD will sell for $6,800 beginning in December. Purchased together, they sell for $13,500.

EEsof Inc., 5743 Corsa Ave., Westlake Village, Calif. 91362.
Phone (818) 991-7530 [Circle 359]

Chip turns multiplying DAC into voltage output type

Each of two bipolar chips, models MP5528 and MP5529, contains all the circuitry required to transform a 12-bit CMOS multiplying digital-to-analog converter into a complete

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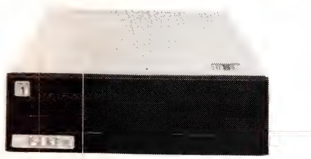

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NF-555C	5¼	ID	Apple IIc	250K	48
NF-051	5¼	ID	Shugart	250K	48
NF-502	5¼	2D	Shugart	500K	48

※Apple II, IIe & IIc are the registered trademarks of Apple Computer Inc.

Mechanism

	Size(inch)	Type	Capacity(byte)	Track Density(TPI)
F-051	5¼	ID	250K	48
F-502	5¼	2D	500K	48
F-301	3	ID	250K	100
F-351	3½	ID	250K	67.5
F-353	3½	IDD	500K	135
F-352	3½	2D	500K	67.5

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voltage-output DAC with a reference. Both chips are designed for use in standard and custom hybrid converters that can perform the requisite laser-trimming of on-chip thin-film resistors.

The MP5528 and MP5529 contain a precision +10-V reference, a programmable negative current source, a high-speed output amplifier, and a set of matched application resistors that permits unipolar and bipolar operation with virtually all available CMOS DACs.

In addition, the chips eliminate superposition errors caused by self-heating, problems with DAC input impedance variation, and the need for source voltage adjustment. Three grades are available in each temperature range.

The unit cost of the chips, which are available in four weeks, ranges from $5.75 to $40.50 for 100-piece orders.

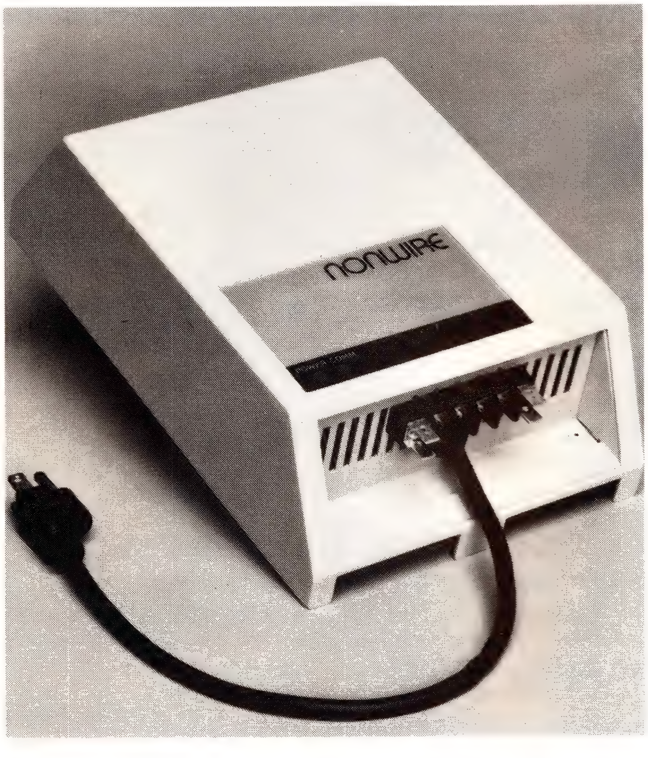
Micro Power Systems Inc., 3100 Alfred St., Santa Clara, Calif. 95050. Phone (408) 727-5350 [Circle 362]

Local net operates at 19.2-K baud without errors

Designed for plant floors and office environments, a short-haul local network links RS-232C and RS-422A equipment to multiple host computers 3,000 ft away over a single pair of 22 telephone station wires at an asynchronous full-duplex data rate of 19.2-K baud.

The local network combines digital correlation techniques with on/off keyed technology, enabling it to handle many protocols. It also has internal buffering, X on/Xoff or hardware flow control, and automatic line turnaround, in addition to multiple layers of error-detection and -correction algorithms.

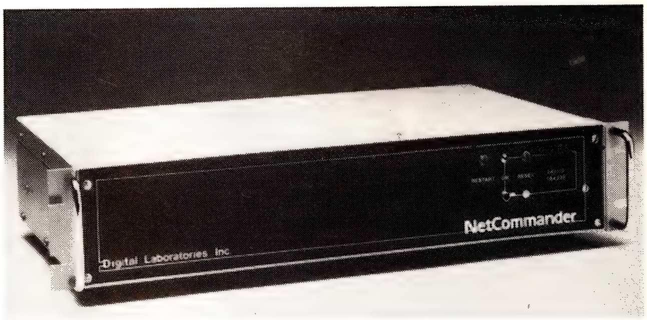
With its built-in limited-token-passing network protocol, it can be connected to host computers to communicate with, broadcast to, or poll any of 255 other RS-232C- or RS-422A-compatible machines. Connections have polarity-insensitive transformer coupling to eliminate the need for dc continuity and remove most routing restrictions in noisy, high common-mode voltage areas.



Star, multidrop, daisy-chain, or combinations of these wiring configurations are supported. RG62A/U cabling permits distances to 7,000 ft. Available now, the local network lists for $1,220.

Controlonics Corp., Nonwire Division, Four Kidder Rd., Chelmsford, Mass., 01824. Phone (617) 256-1918 [Circle 369]

Network for Kaypros needs no file server



The Kaynet local network links up to 64 CP/M computers, thus allowing them to share common data bases and resources. It can link as many as 20 microcomputers and makes disks, files, and printers available to every network user.

Kaynet eliminates the need for dedicating the resources of one or more computers to a file server status. This eliminates full system failure if one unit fails. An interoffice communications system is also built into the net, allowing electronic memos to any unit.

Kaynet will also print to disk files that later may be queued to any printer. Actual printing occurs as a background function and does not interfere with the operator's primary task at a station.

Available now, the Kaynet network costs $300 for each computer conneced on the network.

Kaypro Corp., 533 Stevens Ave., Solana Beach, Calif., 92075. (619) 755-1134 [Circle 370]

Exchange connects 40 to 48 computers, peripherals

The NetCommander is a stand-alone network exchange that connects from four to 48 asynchronous computers and peripherals without hardware or software modification. Automatically handling multiple protocols and baud rates, the turnkey unit provides port contention management, terminals switching, printer sharing, and message store and forward.

The 16-port unit includes a menu-driven configurator including selection of data terminal or data communications equipment wiring and can be linked for expandability. Port names are user defined, routing is automatic, and contention paths may be established without special access codes. The NetCommander sells for $1,095 and up.

Digital Products Inc., 600 Pleasant St., Watertown, Mass., 02172.
Phone (617) 924-1680 [Circle 371]

Cable speeds assembly of microwave systems

A soft-jacketed miniature coaxial cable called Micro-Coax Flexbend is said to make the assembly of microwave transmission systems easier and faster. The coaxial cable comes in 0.0865-in. and 0.041-in. diameters.

Flexbend cable is designed to transmit and receive high-speed high-frequency microwave signals. This provides low loss, total shielding, at or near theoretical values, elimination of radiation leakage, lowest possible attenuation, high-voltage standing-wave ratio performance, and miniaturization.

Applications are said to be for most systems designed for 500 MHz and higher, including computer systems, medical electronics, and communications systems. In componentry, the cable can be used in oscillators and amplifiers, printed-circuit boards, delay lines, and capacitor sections. Since the cable is more pliable, it can be bent by hand into required configurations without damaging performance. No special tools are needed.

MicroDelay Division, Uniform Tubes Inc., Collegeville, Penn. 19426. (215) 539-0700 [Circle 375]

Graphics system serves business, CAD needs

The 6848 color graphics system provides business and scientific color graphics with applications for computer-aided design, process control, and business presentations. Based on the Z80A processor, the 6848 can be used as a stand-alone color graphics system, a computer ACSII terminal, or a 192-K-byte printer buffer. It can use red-green-blue color monitors, RS-170 composite video for monochromes, and split video.

Alphanumerics and graphics may be displayed simultaneously. In the graphics mode, up to eight colors can be displayed from a pallette of 16 in a 640-by-480, 640-by-400, or 640-by-240 format. For alphanumerics, the 6848 emulates Televideo 920 terminal protocols, displays of up to 30 lines by 80 characters, with attributes including blink, graphic characters, underline, and reverse video.

The 6848 measures 12 by 12 by 3 in. and has 194-K bytes of random-access memory and 12-K bytes of erasable programmable read-only memory as standard. An RS-232-C serial port with 110 to 19.2-K baud and parallel printer port is built in. Single unit prices begin at $379.95.

Ultratek Co., 409 S. Raymond Ave., Alhambra, Calif., 91803. (818) 282-9056 [Circle 373]

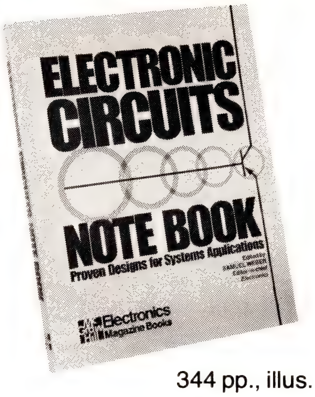
Interface lets IBM PCs serve as controllers

The PC/VME interface allows IBM Corp.'s Personal Computers or compatible units to act as master controllers for a VME bus. This allows personal computers to communicate with a standard slave card of the VME system.

The interface is said to combine the flexibility of the PC with the standard specifications and hardware support of the VME bus. As a master controller, the computer can then eliminate the need for a special, dedicated microprocessor board. Functions cards can be assembled and verfied independently of a 68000 controller board.

The PC/VME meets timing requirements of both the IBM PC and

More Circuits!!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the VME system. It may be used with the PC, PC/XT, or any hardware-compatible PC with an available expansion slot. Functions are driven in languages ranging from Basic to Forth.

The interface includes one PC expansion board, one VME module, connecting cable, and software. Available now, the PC/VME interface is priced at $835.

Ajida Technologies, 2226 Durant Ave., Suite 309, Berkeley, Calif., 94704. (415) 548-6434 [Circle 372]

Trimmer line uses bulk metal-foil technology

The 1208, 1248, and the 1268 are a line of industrial and commercial trimming potentiometers manufactured with bulk metal-foil technology. The line is said to offer a ±20 ppm/°C temperature coefficient of resistance with a ±50 ppm/°C coefficient through the wiper. The 1208 is a 1¼-in. rectilinear RJ12-style trimmer with resistance range from 20 to 10,000 Ω and tolerances of ±20% to ±10%.

The 1248 and 1268 trimmers, ¼-in. square (RJR26-style) and ⅜-in. square (RJR24-style), respectively, both have a resistance range of 20 to 5,000 Ω with a tolerance of ±10%. All three trimmers have a ±0.1% typical and ±0.5% maximum change in setting stability.

Vishay Resistive Systems Group, 63 Lincoln Highway, Malvern, Penn., 19355. (215) 644-1300 [Circle 366]

Two capacitor lines suppress radio frequency interference

Two capacitor lines, the HI-F Filter and the HI-C blocking capacitor, are geared for the switching power supply market. Both have metalized polypropylene construction and high-frequency, high-current applications. Intended as an alternative to other means of radio frequency interference suppression, the HI-F filter capacitor is designed to eliminate the interference generated by high-speed switching circuits from contaminating lines used by other more sensitive equipment such as computers.

The HI-F is classified into two categories, Type X-2 for line-to-line use and Type Y for line-to-ground use. Both are rated for 250 V ac operation with typical capacitance ranges of 0.01 to 1.0 μF for the X-2 and 0.001 to 0.022 μF for the Y. Typical applications for the HI-C blocking capacitor include input/output filtering, snubber circuits, and dc blocking in high-frequency switching power supplies. Designed for high current capability, low dissipation at high frequencies with self-healing and clearing properties, the HI-C capacitance range is from 0.47 to 6.8 μF at 250 V ac and 0.47 to 2.2 μF at 400 V dc.

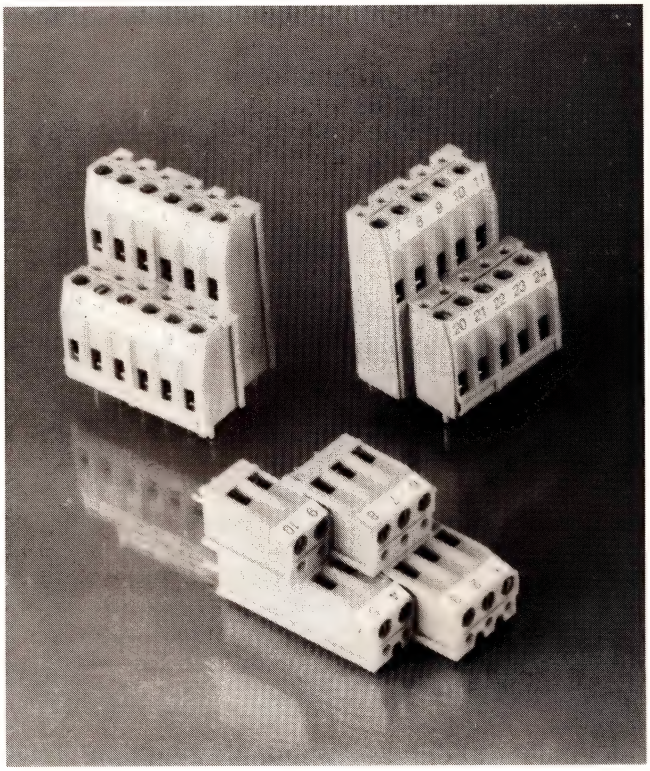
General Electric Co., Capacitor Products Dept., Hudson Falls, N.Y. 12839. Phone (518) 761-5605 [Circle 376]

Double-tier terminal strip permits high board density

A compact double-tier terminal strip can be interlocked to form any number of pole configurations. Available in 2, 3, 8, and 12 poles, the 8190E series reduces inventory and simplifies ordering. With a pin spacing of 5 mm, the double-tier terminal increases board density.

The two tiers, offset by half-pin spacing, ensure access to—and allow a view of—all lower connection points. Series 8190E terminals can be mixed with type 8190 single-level terminals. Molded from break-resistant Polymid 6.6, the 8190E series can withstand continuous service temperatures up to 212° F. Rated at 300 V ac, 15 A, the series has been approved by Underwriters Laboratories for field and factory wiring.

All metal parts are either recessed or enclosed in the insulating body, providing circuit protection and dead-front safety. Wiring clamping connectors encompass wire



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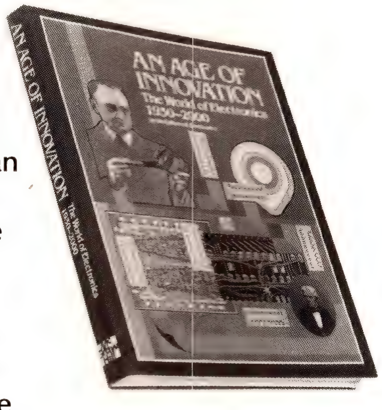

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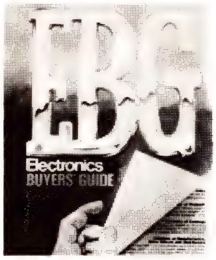

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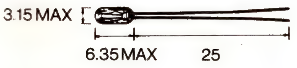

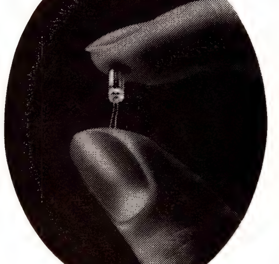

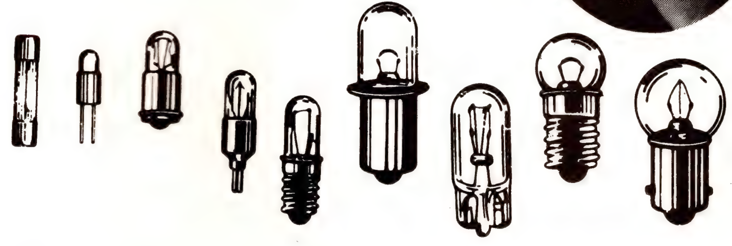

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sizes from 22 AWG (American Wire Gauge) through 12 AWG. The clamping connectors and the screws are steel, zinc-plated, and chromated. The solder pin is 0.9 by 0.8 mm, and comes with or without markings.

Typically, the three-pole version in quantities of 100 sell for $237.88, and are available from stock.

Electrovert Inc., 399 Executive Blvd., Elmsford, N.Y. 10523.
Phone (914) 592-7322 [Circle 377]

Tiny slide switches fit on cramped boards

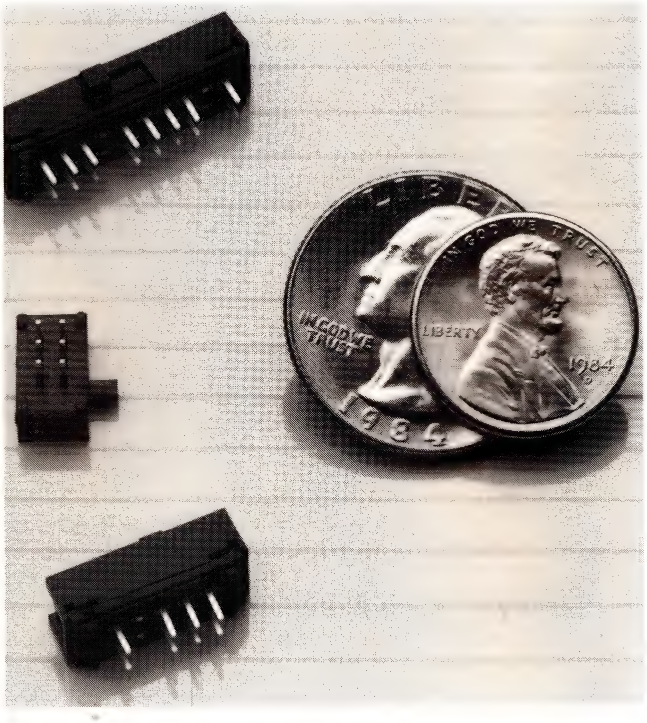
Offering high performance in a small package, two series of slide switches, the MMS and the SSJ microminiature lines, are suitable for printed-circuit-board applications where space is severely limited. For example, the model SSJ-12, a single-pole double-throw switch, measures just 0.394 by 0.157 by 0.26 in. high, including the actuator.

Both lines have double-wipe contacts, usually available only in larger telecommunications-grade switches. The case is constructed of rugged plastic, and includes a snap detent for tactile cues. Silver-plated contacts are standard with a rating of 100 mA at 30 V dc, and the life rating is 10,000 operations.

The MMS line comes in one-, two-, and four-pole versions; the single-pole type has an upright actuator with an on-on function. The two- and four-pole types are available with upright or side actuators as well as two-position on-on, and three-position on-on-on functions. The SSJ series is available in single- and double-pole versions with upright or side actuators. The single-pole type is available with a two-position on-on or a three-position on-on-on function. The double pole is available in a two-position on-on version.

Both lines are available from stock. The price of a single-pole double-throw MMS version is $0.36 when ordered in 1,000-piece lots.

Augat Inc./Alcoswitch, 1551 Osgood St., North Andover, Mass. 01845. Phone (617) 685-4371 [Circle 378]



Safety features stand out on durable multimeters

Heavy-duty analog-digital multimeters, the series 20, are intended by the manufacturer for harsh environments where instruments and operators are both heavily stressed. The models 25 and 27 have built-in overload protection, high-energy fuses, and a case designed to withstand up to 1,000 V above safety standards.

The manufacturer guarantees calibration for one year regardless of drops, shock, vibration, or water and chemical attack in heavy-industry environments. The meters are shielded from excessive electromagnetic interference, and the liquid-crystal display is designed to work at extreme temperatures.

A chip designed for the series offers 0.1% dc accuracy, 100 μV to 1,000 V ac and dc, 0.1 μA to 10 A ac and dc, and 0.1 to 32 MΩ resistance. The chip can also measure up to 10,000 MΩ with a conductance function and measures in-circuit resistance without turning diodes or transistors.

The manufacturer claims that 3,200-count display offers up to 10 times greater resolution than that provided by 3½-digit 2,000-count multimeters. Two modes on the model 27 provide special features: the min/max mode stores the lowest and highest readings taken and recalls them on command; the relative mode measures differences rather than absolute values. The series 20 will be available November 1; the model 25 will sell for $229, the model 27 for $259. The C20 sells for $20, the C25 soft case for $15.

John Fluke Mfg. Co., P.O. Box C9090, Everett, Wash. 98206.
Phone (206) 342-6300 [Circle 379]

Process-control system is fault tolerant

A fault-tolerant process-control system, the CS330, is said to have fewer components than comparable systems. The stand-alone system provides logic and regulatory control. Two software packages are available. The TRI-GARD package is designed for safety shutdown and discrete control functions, while the TRI-DAC offers continuous control. Both packages can be integrated into one system. The CS330 consists of a chassis housing a motherboard, three control computer boards, a four-port serial input/output board, up to 14 process I/O boards, and a triple power-supply unit.

Each control computer board has an 8086-2 microprocessor and an 8087-2 math coprocessor, up to 1 megabyte of random-access memory and 320-K bytes of read-only memory, an interboard communicator, and a controller. The CS330's base price is about $40,000.

August Systems Inc., 18277 S.W. Boones Ferry Rd., Tigard, Ore. 97223. Phone (503) 684-3550 [Circle 380]

Meetings

International Automation Systems and Microelectronics Exhibition, Fast-Federazione delle Associazioni Scientifiche e Techniche (Exhibition Secretariat: Viale Premuda, 2-20129 Milano, Italy), Fairgrounds, Milan, Italy, Dec. 3-4.

Semicon/Japan '84, Semiconductor Equipment and Materials Institute (William F. Galarneau, SEMI, 625 Ellis St., Suite 212, Mountain View, Calif. 94043), Tokyo International Trade Center, Tokyo, Dec. 3-5.

Digital Avionics Systems Conference, IEEE (Randal K. Moore, General Dynamics/Ft. Worth, P.O. Box 748, MZ 2452, Fort Worth, Texas 76101), Baltimore, Dec. 3-6.

Educatec 84, Second Exhibition for Teaching and Training Equipment, Material and Techniques, Edit Expo International (Sylvie Danon, 12 rue Leon-Cogniet, 75017 Paris, France), Porte de Versailles, Paris, Dec. 3-7.

Scan-Tech '84, Automatic Identification Manufacturers Inc. and Material Handling Institute Inc. (Automatic Identification Manufacturers Inc., 1326 Freeport Rd., Pittsburgh, Pa. 15238), Convention Exposition Center, Cincinnati, Dec. 4-6.

1984 Western Design Engineering Show, American Society of Mechanical Engineers (Show Manager, Western Design Engineering Show, 999 Summer St., Stamford, Conn. 06905), Moscone Center, San Francisco, Dec. 4-6.

Fourth Videodisc, Optical Disk, and CD-ROM Conference, Meckler Communications (520 Riverside Ave., Westport, Conn. 06880) Washington Hilton, Washington, D.C., Dec. 5-7.

California Computer Show, Norm DeNardi Enterprises (289 S. San Antonio Rd., Suite 204, Los Altos, Calif. 94022), Hyatt Hotel, Palo Alto, Calif., Dec. 6.

1984 IEEE International Electron Devices Meeting, IEEE (Melissa M. Widerkehr, Courtesy Associates, Inc., 655 15th St. N.W., Suite 300, Washington, D.C. 20005), San Francisco Hilton and Towers, San Francisco, Dec. 9-12.

The Sixth DEC-Compatible Industry Exposition, Expoconsul International Inc. (55 Princeton-Hightstown Rd., Princeton Junction, N.J. 08550), Disneyland Hotel, Anaheim, Calif., Dec. 11-14.

Computer Networking Symposium, IEEE, Computer Society, and National Bureau of Standards (Robert Rosenthal, B226 Technology Building, NBS, Washington, D.C.), Gaithersburg, Md., Dec. 12.

Com-Struct '85, Slater Publications Inc. (Com-Struct '85, 163 Highland Ave., Needham Heights, Mass. 02194), Bayside Exposition Center, Boston, Jan. 8-10.

IC Assembly Automation Conference, Intem Show Management (Malka Nagel, P.O. Box 390207, Mountain View, Calif. 94039), Le Baron Hotel, San Jose, Calif., Jan. 9-10.

Telecommunications for Pacific Development: Toward a Digital World, Pacific Telecommunications Council (1110 University Ave., Honolulu, Hawaii 96826), Sheraton-Waikiki Hotel, Honolulu, Jan. 13-16.

Seminars

Practical Statistical Analysis with Reliability Applications, Reliability Analysis Center (Reliability Analysis Center, RADC/DAC, Griffiss AFB, N.Y. 13441), Sheraton-Twin Towers, Orlando, Fla., Dec. 3-6.

CAD/CAM, Frost & Sullivan Inc. (Wendy Engelberg, Frost & Sullivan Inc., 106 Fulton St., New York, N.Y. 10038), Cathedral Hill Hotel, San Francisco, Dec. 17-19.

Business Graphics, Frost & Sullivan, Inc. (Wendy Engelberg, Frost & Sullivan Inc., 106 Fulton St., New York, N.Y. 10038), Cathedral Hill Hotel, San Francisco, Dec. 20-21.

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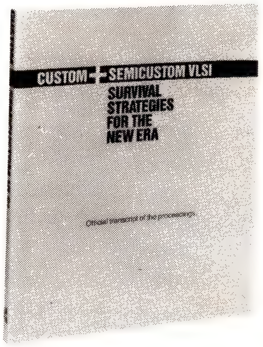
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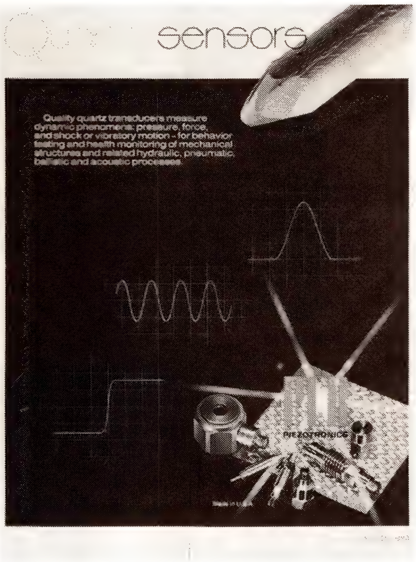
[Circle reader service number 421]

Standard issue. A new Recommended Standard, "Microscopic Method for Measuring Fiber Geometry of Optical Waveguide Fibers," has been released by the Electronic Industries Association. The test method measures five fiber-geometry parameters. At $8 for one copy, order RS-455-55 from Electronics Industries Association, Standard Sales Office, 2001 Eye St. N.W., Washington, D.C. 20006. Phone (202) 457-4981. [Circle 422]

Crystal clear. A 140-page catalog of quartz and tourmaline sensors has information on charge and voltage-mode amplifiers, cables, and accessory hardware, and it contains documentation for the Aronson shockless pressure pulse calibrator and many other items. Request catalog 884 from PCB Piezotronics Inc., 3425 Walden Ave., Depew, N.Y. 14043. Phone (716) 684-0001. [Circle 423]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[Circle 424]

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[Circle 425]

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Classics classified. Two reprints have been issued by the IEEE Press: *Microwave and Millimeter-Wave Mixers* (PC01735) at $35.95 (members) or $66.95 (nonmembers); and *MOS Switched Capacitor Filters: Analysis and Design* (PC01701) at $40.15 (members) or $66.95 (nonmembers). A $2 billing charge is added to nonprepaid orders. Place your order with the IEEE Service Center, 445 Hoes Lane, Piscataway, N.J. 08854. [Circle 429]

Standard bearers. The International Electrotechnical Commission (IEC) has issued two publications: "Semiconductor Devices. Integrated Circuits. Part 1: General" (pub. 748-1) and "Dimensions of Planchets Used in Nuclear Electronic Instruments" (pub. 248) (revised edition). For order information, write Information Officer, Central Office, IEC, 1 Rue de Varembe, 1211 Geneva 20, Switzerland. [Circle 428]

Twins. The IPC Blue Catalog lists technical publications, artwork and testboards, and educational videotapes. It also reports on IPC guidelines including illustrated documents depicting acceptability levels. The Red Catalog lists technical papers available from the institute's semiannual meetings. The set is available free from the Institute for Interconnecting and Packaging Electronic Circuits, 3451 Church St., Evanston, Ill. 60203. Phone (312) 677-2850.
[Circle 430]

Film stars. A 12-page engineering catalog covers this company's full line of thick-film screens for fine-line printing by the microelectronics industry. In addition, the catalog contains substantial engineering information on the silk-screening process.

For a complementary copy, call IRI Screen Products at (603) 883-1363. The company is located at 15 Sagamore Park Rd., Hudson, N.H. 03051. [Circle 431]

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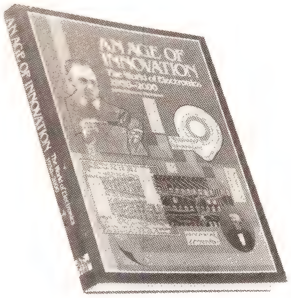

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Letters

Likes C

To the editor: I would like to make two points concerning Louis Schirm's scathing criticism of C [*Electronics*, May 31, 1984, p. 8]. First, Mr. Schirm says "C is the worst language I have had to deal with." This naturally gives rise to the question: exactly which languages has Mr. Schirm had to deal with? He mentions only Basic, which is a totally different world than C. If all you have to worry about is writing games programs for your toy computer, it is not surprising that you would jump up and down with excitement over the prospect of writing Basic programs, but C was designed for completely different applications.

Second, regarding the point made by G. Gaugler's strong rebuttal to the Schirm letter [*ElectronicsWeek*, Aug. 6, 1984, p. 102], about the statement form "i+=2", I disagree with Gaugler's analysis of the compiler's implementation of this form of statement. Regardless of whether you write "x=y+2" or "i+=2", the machine operations involved are the same—that is, operand fetch, operand load into ALU, arithmetic operation in ALU, and operand store in memory or register. Therefore, the C form does not result in any saving in machine time, although, of course, there are many other features of C that make it very efficient in terms of the code generated by a compiler.

At present, C is my favorite language, although at first I, too, like Gaugler, resisted it.

Mohan Raju
Islington, Ont., Canada

Corrections

A caption appearing in the story "Japan looms as a key market for U.S.-made supercomputers," [ElectronicsWeek, *Sept. 24, 1984, p. 18*] *identifies a supercomputer as built by Cray. Sharp-eyed readers will have noticed that it is a Denelcor machine. They will also have noticed that LaserData's disk was shortchanged* [ElectronicsWeek, *Sept. 17, 1984, p. 20*], *attributed with holding 800-K bytes per side. That, of course, should have been 800 megabits.*

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Oftel, Britain's watchdog equivalent of the Federal Communications Commission, has demonstrated with its first bark that it means to be listened to. Largely on its advice, the British government has turned down a British Telecom-IBM proposal for a value-added data communications network for the UK.

The government decision, which came days before British Telecom is returned to the private sector as Britain's largest company, demonstrates that the agency means business about introducing competition. The debate has also proved a baptism of fire for Oftel (Office of Telecommunications), created at the same time as the privatized British Telecom to keep a watchful eye on the industry.

In coming to its decision, the agency, under its first director general, Bryan Carsberg, had to weigh some positive advantages in the British Telecom-IBM proposal against the more fundamental benefits of providing a truly competitive environment. British Telecom, together with IBM, had made a good case for the joint service. A network based on IBM's Systems Network Architecture would meet an immediate market need, and would accelerate the development of value-added networks in the UK. The alternative, open systems standards, are less well developed, says British Telecom. Furthermore, by linking with IBM, British Telecom would be better placed to develop gateways between the two networks and to fulfill a longer-term goal of converging the two standards. In fact, it seems that Oftel was prepared to accept British Telecom's provisions for open-systems interconnection—the standard BT is to use for its packet-switched network.

But in the end Carsberg sided with the widely held industry view that such a combination would stifle competition in the nascent value-added market. As a result, there will likely be three competitors of more equal stature competing in this critical new market.

From a U.S. vantage point, the decision is not only fair but it makes good business sense. Put in an American context, consider how the FCC would view a union between IBM and AT&T. What's more, now that Oftel has shown its mettle, the direction for telecommunications in Britain is somewhat clearer: fledgling competitors of British Telecom can take heart. Under the eyes of Oftel, they are less likely to be crushed before they can grow. And the bottom line is that all may even learn to live together—to the advantage of the customer.

. . . AS WELL AS ONE FOR THE CONGRESS

The U.S. Congress, in its rush to adjourn, managed to approve two measures much needed by the electronics community. The first, the Omnibus Tariff and Trade Bill, forces the President to encourage high-technology exports through agreements with other nations. The catch-all law also deals with subjects ranging from dumping to tariffs. The second measure, designed to cut waste in procurement of military spare parts, increases participation by small businesses and requires major changes in bid practices. We heartily approve.

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Current DoD funded insertion programs at TI include Pave Pillar 1750A; ICNIA; ITARS; LHX; M-1 Fire Control; and weapon guidance for IR Hellfire/JSS, TOW 2, and the Launch-and-Leave Glide Bomb. VHSIC technology at TI is also being expanded to include 0.5-micron geometries for application to future autonomous guided weapons for the Army, Navy, and Air Force.

TI is a DoD prime contractor for VHSIC Phase I development, Phase III R&D activities, the Phase II Submicron Definition Program, and is teamed with Intermetrics and IBM for the VHSIC Hardware Design and Development Language (VHD^{2}L) Program.

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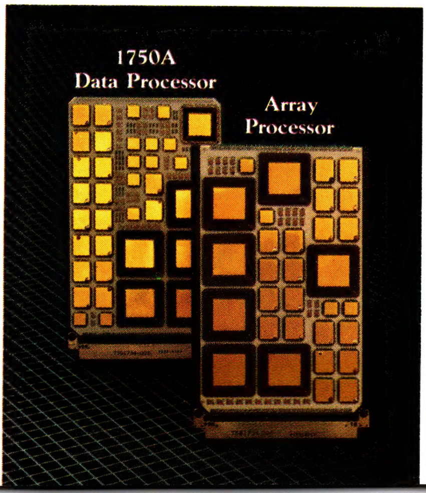

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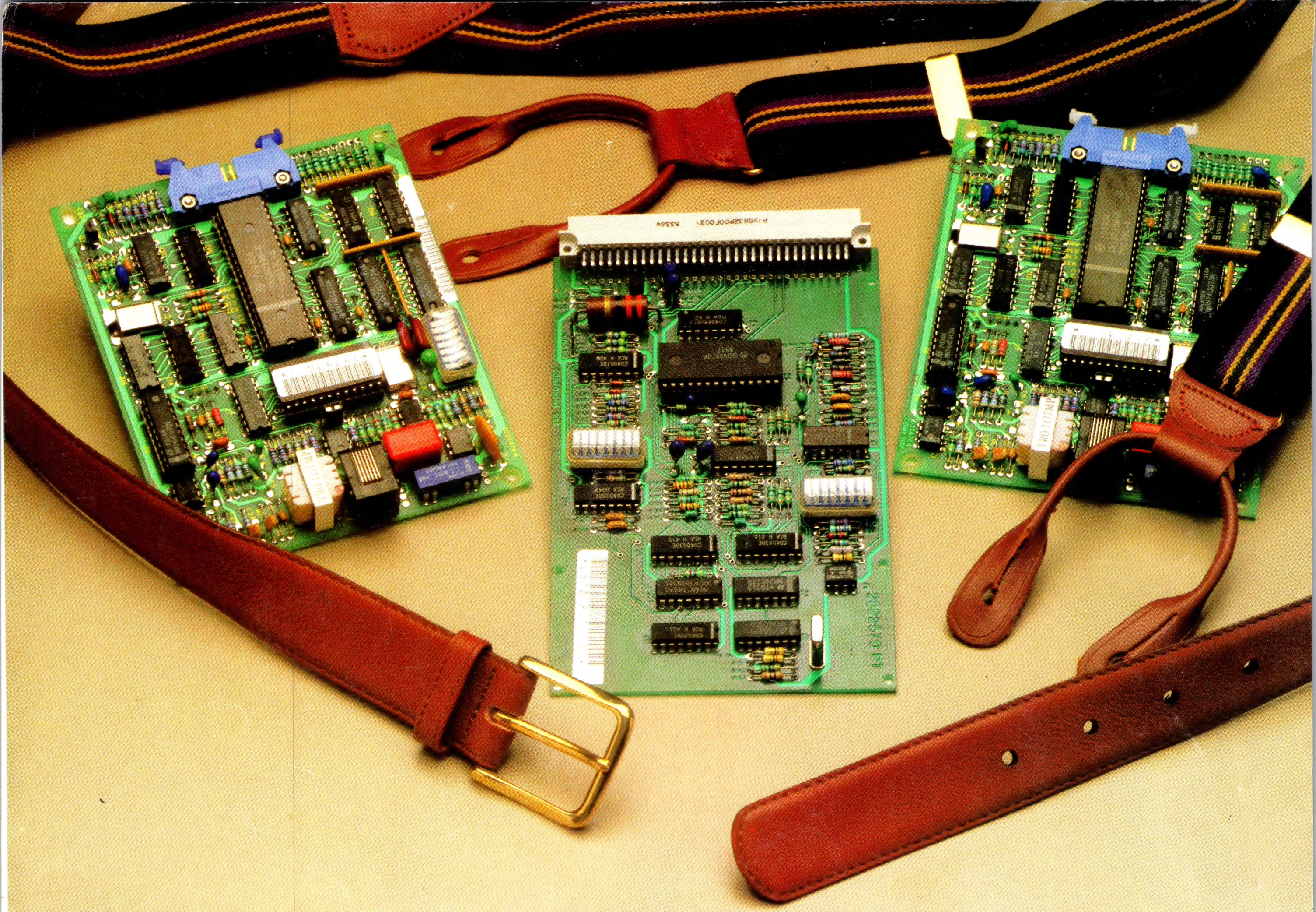

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